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Indian and
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Mackenzie Valley Pipeline Inquiry, Summaries of Proceedings

Volume 1
Construction and Engineering

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Mackenzie Valley Pipeline Inquiry, Summaries of Proceedings

Volume 1

Construction and Engineering

Yellowknife, N.W.T. and Whitehorse, Y.T.
March 3, to November 20, 1975

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Hon. Judd Buchanan, PC, MP,
Minister of Indian and Northern Affairs,
Ottawa, 1976.
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PREFACE

The Mackenzie Valley Pipeline Inquiry was established on March 21, 1974 by Order-in-Council P.C. 1974-641. The Minister of Indian Affairs and Northern Development, Jean Chrétien, at the same time appointed Mr. Justice T.R. Berger of the Supreme Court of British Columbia as Commissioner of the Inquiry charged with the task for inquiring into and reporting upon the terms and conditions that should be imposed in respect of any right-of-way that might be granted across Crown lands in the Yukon and Northwest Territories for a proposed Mackenzie Valley pipeline, having regard to:

1. The social, environmental and economic impact regionally, of the construction, operation and subsequent abandonment of the proposed pipeline in the Yukon and Northwest Territories, and,
2. Any proposals to meet the specific environmental and social concerns set out in the Expanded Guidelines for Northern Pipelines of 1972.

An application for the grant of right-of-way under authority of the Territorial Lands Act for the purpose of constructing a pipeline across Crown lands in the Yukon and Northwest Territories to transport natural gas from Prudhoe Bay and the Mackenzie Delta to southern markets in the United States and Canada was submitted to the Department of Indian Affairs and Northern Development by Canadian Arctic Gas Pipeline Limited on March 21, 1974. On May 1, 1975, Foothills Pipe Lines Limited, in conjunction with Alberta Gas Trunk Line (Canada) Limited, submitted an application for a grant of right-of-way to construct an all-Canadian pipeline up the Mackenzie Valley to transport natural gas from the Mackenzie Delta to southern Canadian markets. These two proposals were referred to Mr. Justice T.R. Berger for examination by his Inquiry at public hearings.

Justice Berger held preliminary hearings to inquire into and determine the nature of the public hearings in Yellowknife, Inuvik, Whitehorse and Ottawa in late April and early May, 1974, and issued preliminary rulings as a result of these hearings. Procedural hearings were then held by the Inquiry in Yellowknife on September 12 and 13, 1974 to receive comments on proposals by Commission Counsel regarding timing and procedural rules for future public hearings. As a consequence it was decided to hold formal hearings in Yellowknife, N.W.T., and in Whitehorse, Y.T., and that the hearings would be defined in subject areas comprising:

- Phase I - Construction and Engineering
- Phase II - Impact on the Physical Environment
- Phase III - Impact on the Living Environment
- Phase IV - Impact on the Human Environment

Community hearings were to be informal, ie., not confined to a particular phase, and witnesses appearing would not be cross-examined. These hearings would be held in communities throughout the Territories which were most likely to be affected by pipeline development activity. In addition, hearings would be held in major centres in southern Canada. A schedule of hearings which have taken place to date of printing and a tentative schedule of anticipated hearings is attached as Appendix V.

The Mackenzie Valley Pipeline Inquiry summaries will be published in several volumes of which this is the first. Other volumes will comprise community hearings, impact on the physical and living environments, socio-economic impacts, Delta developments, southern centres hearings and final arguments.

The summaries are prepared primarily by Mr. Don Gamble of the Northern Policy and Program Planning Branch of the Department of Indian Affairs and Northern Development with the editorial assistance of Mrs. Nancy Lonnay. They appeared originally in a numbered, chronological series and were widely distributed in that form. Reference is made to this numbered series in Appendix V. The summaries attempt to provide, in abstract, information which is contained in the lengthy transcripts of the Inquiry proceedings. They are an unofficial guide to the transcripts and should not be construed as representing any position or policy of the Department of Indian Affairs and Northern Development.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARIES OF PROCEEDINGS

Construction and Engineering

Yellowknife, N.W.T. and Whitehorse, Y.T.
March 3, to November 20, 1975

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MACKENZIE VALLEY PIPELINE INQUIRY

SUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. IX TO XIV)

PROCEDURAL HEARING

YELLOWKNIFE, N.W.T.

MARCH 3 TO 8, 1975

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The Mackenzie Valley Pipeline Inquiry Hearings commenced March 3, 1975 in Yellowknife, Northwest Territories. The summary presented below covers the highlights of the Hearings for the period March 3-8, 1975.

CANADIAN ARCTIC GAS PIPELINE LIMITED
Mr. Pierre Genest (Counsel)

TRANSCRIPT REFERENCE

CAGPL outlined its application noting revised cost estimate of \$7 billion to construct a pipeline 2,435 miles long. Genest reviewed need for gas in United States and Canada, prime pipeline routing. Company's stand is that pipeline can be built without prejudice to settlement of native land claims and ended with a suggestion that the hearings not become too long.

Vol. IX
 pages 768 to 781

Mr. Genest mentioned alternative "Cross Delta routing" being studied by Arctic Gas and indicated material would be shortly filed with Inquiry and the Minister.

He also outlined briefly the Canadian energy shortage and the United States energy shortage. Mr. Genest said it was not economically feasible to construct a pipeline for the exclusive purpose of shipping Delta frontier gas to Canadian markets, a joint line carrying American and Canadian gas would always remain the most economic alternative.

FOOTHILLS PIPE LINES LTD.
Mr. Reg Gibbs (Counsel)

Foothills outlined its generalized view of weaknesses in CAGPL application and indicated it would file its own evidence/application from end of March to early April.

Vol. IX
 pages 782 to 791

Mr. Gibbs questioned technical and financial aspects of CAGPL's filing. He also pointed out the limited Canadian content in the Canadian Arctic Gas Pipeline Ltd. consortium and the large scale Canadian public financial subscription which would be required to help finance the project.

Mr. Gibbs urged an all Canadian line joining existing pipelines in southern Canada.

Foothills Pipelines Ltd. - Cont'd.TRANSCRIPT REFERENCE

Mr. Gibbs questioned pipeline size south of Travaillant Lake, suggesting request for right-of-way was for two 48" pipelines rather than one based on gas feed-in from Prudhoe Bay to Mackenzie Delta sector and Mackenzie Delta gas.

CANADIAN ARCTIC RESOURCES COMMITTEE

Mr. Russell Anthony (Counsel)

CARC outlined its organization. Mr. Anthony said Government, industry, NEB were not disclosing full facts. A request by CARC to Commission Counsel for access to DOE experts and reports (March 4th, pages 845 to 846) was largely satisfied by a verbal assurance by Counsel (March 4th, pages 915 to 196) and a letter* from the Minister DOE read into the record on March 6th (page 1,322). A meeting between Commission Counsel and DOE officials was scheduled for March 10th in Edmonton.

CARC indicated it felt only a limited examination of pipeline routings had been made by CAGPL. It also urged a thorough study of the corridor concept contained in the 1970-1972 pipeline guidelines prior to the granting of a right-of-way.

NORTHWEST TERRITORIES INDIAN BROTHERHOOD
AND METIS ASSOCIATION - Mr. Glen Bell (Counsel)

Mr. Bell stated the Inquiry was the best way for native people to place their position on the settlement of land claims before the Canadian public. Their position is no pipeline before land claims are resolved. Native people want control of their own economic development.

Vol. IX
Pages 804 to 818

Mr. Bell pointed out that later evidence would be placed before the Inquiry showing extensive land use by native people and the importance of the Mackenzie Valley.

COMMITTEE FOR ORIGINAL PEOPLES
ENTITLEMENT; INUIT TAPIRISAT OF
CANADA - Mr. John Bayly (Counsel)

Mr. John Bayly representing COPE/ITC stressed the importance of land claims settlement before pipeline construction or other major development. If development is to come, people want to be ready for it and wish to participate in it.

Vol. IX
Pages 818 to 825

Mr. Bayly informed the Inquiry of the extensive land use study begun in 1973 and the land claims legal brief begun in 1972 with the work nearly complete.

* See attachment

COUNSEL FOR YUKON INDIANS
Mr. Ron Veale (Counsel)

Mr. Veale explained to the Inquiry the Council for Yukon Indian represents all Indians in the Yukon and was organized to negotiate the land claims settlement with the government of Canada. The council has insisted no major developments take place to further prejudice native rights. The proposed pipeline is just such a development.

ENVIRONMENT PROTECTION BOARD -
Mr. Carson Templeton (Counsel)

Mr. Templeton outlined the background of the Environment Protection Board its membership and interests in environmental protection. The Board, an independent research group, is funded by CAGPL - but is autonomous in its publications of research findings. Mr. Templeton emphasized the need for sound environmental guidelines and a control agency.

NORTHWEST TERRITORIES ASSOCIATION OF
MUNICIPALITIES - Mr. Murray Sigler (Counsel)

The N.W.T. Association of Municipalities stated their concern that they will be left with a major economic/social burden during and after construction.

Mr. Sigler emphasized the importance of the community hearings in that the important factors related to each municipality and its residents would be brought out.

He outlined a consultant study being completed which would indicate community impacts, make recommendations, deal with gas distribution from pipeline into communities and the lead time required to obtain proper municipal services.

OVERVIEW HEARINGS

The overview hearings constituted presentations by scientists, elderly native people, and other resource persons listed below and covered the physical, biological, political and socio-economic scenarios of the Mackenzie Valley and Northern Yukon.

A Physical Environment

General: John Fyles (E.M.R.)

Permafrost: Ross McKay (U.B.C.)

Geomorphology: Michael Church (U.B.C.)

TRANSCRIPT REFERENCE

Vol. IX
 Pages 825 to 826

Vol. IX
 Pages 827 to 835

Vol. IX
 Page 835 to 842

Vol. X - pages 851 to
 878

Pages 879 to 914

Pages 918 to 979

Overview Hearings - Cont'd.TRANSCRIPT REFERENCEB Biological Environment

Vegetation: Lawrence Bliss (U. of Alta.)	Vol. XI Pages 983 to 1,091
Mammals: Ron Jakinchuk (Renewable Resources Consultating Services Ltd.)	Pages 1,042 to 1,110
Birds: John Livingston (York Univ.)	Pages 1,102 to 1,167
Aquatic Systems: Lee Doran and Associates Ltd. Chris Hatfield (formerly E.P.S.)	Vol. XI-A Pages 1,171 to 1,227

C Human Environment

Anthropology: June Helm (U. of Iowa) John Stager (U.B.C.)	Vol. XII pages 1228 to 1321
Economic Participation: Stewart Jamieson (U.B.C.)	Vol. XII pages 1329 to 1370
Development: Tom Espie (N.W.T. Government) Director, Dept. Economic Dev.	Vol. XII pages 1372 to 1383
Northern Small Business: John MacAleer (Yellowknife)	Vol. XII pages 1383 to 1396
Political Development: Louis E. Hamelin (Prof. at Laval and former N.W.T. Council appointed member)	Vol. XIII pages 1399 to 1441

D On Native Organizations

N.W.T. Métis Association: Rick Hardy (Pres.)	Vol. XIII pages 1442 to 1447
C.O.P.E.: Sam Raddi (Pres.)	Vol. XIII pages 1447 to 1451
N.W.T. Indian Brotherhood: James Wah-Shee (Pres.)	Vol. XIII pages 1451 to 1463

E On Native Life (by personal history)

Tuktoyaktuk: Jim Wolkie (Inuit)	Vol. XIII pages 1464 to 1474
Fort Providence: Vital Bonnetrouge (Indian)	Vol. XIII pages 1475 to 1495
Fort Norman: Fred Andrew (Indian)	Vol. XIII pages 1496 to 1509

F On Oil Industry and Construction

Oil and Gas Industry: C.D. Bailey (H.A. Simmons)	Vol. XIV pages 1512 to 1555
Northern Construction: R.F. Legget (N.R.C. retired)	Vol. XIV pages 1557 to 1603

The technical overview on the physical and biological environment was straightforward. The human environment panel was highlighted by a strong statement by Dr. Jamieson on the benefits of delaying the pipeline. This was followed by a presentation by Dr. Espie (N.W.T.) dealing with a philosophy of development in the N.W.T. The Presidents of the various native organizations made strong statements opposing the pipeline until the land claims are settled. Dr. Hamelin made a lengthy political analysis of Territorial Affairs which urged acceleration of providing greater responsibility to the Territorial Governments. The three native elders spoke of their lives since the turn of the century. The importance of the land was stressed by all three spokesmen. In the presentation of the Oil and Gas Industry techniques, performance, finance and future, Mr. Bailey made an appeal for a National Oil Policy. In the concluding presentation Dr. Legget outlined northern construction as it related to permafrost, climate, transportation and manpower. His overall view was that any project can be safely built from an engineering point of view if there is a need and the money is available.

INQUIRY SCHEDULE

The hearings are expected to be held in Yellowknife in three week cycles interrupted by a one week recess and, perhaps, one week of informal community hearings.

The first panel of witnesses (see p. 8) will be called by Arctic Gas on March 11th. It is anticipated that the first and second panels will give evidence and be cross-examined before the one week recess commencing March 22nd. Informal hearings will be held in Aklavik from April 2nd to 4th. Formal hearings will then resume in Yellowknife for three weeks with evidence from the balance of the panels list below.

Phase 1: Engineering and Construction

- Panel 1: Facilities Location (Application, Section 8.a.), Connecting Pipeline Facilities (Section 9) to be given by a panel consisting of P.H. Dau, G.L. Williams, D.W. Watson and Dr. J.D. Mollard.
- Panel 2: Geotechnical Aspects of Engineering Design of the Pipeline and Ancillary Facilities. This evidence will be given by a panel consisting of J.I. Clark, N.R. Morgenstern, Richard H. Cooper, R.M. Hardy, W.A. Slusarchuk, G.W. Hollingshead and E.C. McRoberts.
- Panel 3: System Configuration and Design of Facilities, being the materials contained in Section 8.b. except for those dealt with by the second panel named above. The panel here will consist of H. Purcell, G. King, C. Reid, C. Koskimaki, J. McMullen, J. Price, and K. Rathje.
- Panel 4. Construction Plan. (Section 13.a. of the application). The composition of this panel will be announced later.

*Letter to Mr. Justice T.R. Berger
from Madame Jeanne Sauvé March 6, 1975*

Read into the record at the Inquiry March 6

Dear Mr. Justice Berger:

Re: Mackenzie Valley Pipeline Inquiry

I am concerned that an impression is being created that I do not intend to co-operate fully with your Inquiry into "the terms and conditions that should be imposed in respect of any right-of-way that might be granted across Crown lands." Any such impression is wholly false.

It is my intention to ensure that any participant in the Inquiry has access to all relevant documents and report in the possession of my department that the participant may require, subject only to any privilege I may be obliged to claim. It is also my intention to ensure that no obstacle is placed by officials of my department in the way of any participant who wishes to consult with any employee of my department whose knowledge of environmental matters the participant may wish to adduce as evidence by calling such employee as a witness.

I propose to make public the text of this letter after you have received it.

Yours sincerely,

(Mme.) Jeanne Sauvé

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. XV TO XVIII)

ARCTIC GAS - FACILITIES LOCATION AND
CONNECTING PIPELINE FACILITIES

YELLOWKNIFE, N.W.T.

MARCH 11-14, 1975

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TOPIC: Phase 1; Engineering and Construction of Proposed Pipeline; Panel on:

- Facilities Location (Section 8a of Application)
- Connecting Pipeline Facilities (Section 9 of Application)

DATE: Sittings March 11 to 14 inclusive, Yellowknife

WITNESSES: Panel on Facilities Location and Connecting Pipeline Facilities;

P.M. Dau - President Northern Engineering Services Company Ltd. (NES)
 G.L. Williams - Director of Field Services, NES
 D.W. Watson - Engineer NES
 J.D. Mollard - President, J.D. Mollard and Assoc. Ltd. Regina (airphoto interpretation)

HIGHLIGHTS:

TRANSCRIPT REFERENCE

A. Technical/Engineering

- The proposed prime route and alternate route of the pipeline, including the route change amendment to the east of Fort Simpson, was given by Mr. Dau. Vol. XV pages 1655 to 1665
- Route selection techniques as applied to this project were outlined by Mr. Dau and Dr. Mollard. Vol. XV pages 1665 to 1716 and 1727 to 1739
- The Fort Simpson Relocation Amendment was filed because of its economy over the original routing, according to Mr. Dau. The decision to dual major river crossing favoured the route as amended. Vol. XV pages 1724 to 1727
- The Cross Delta Alternative Routing, to be filed within the next few weeks, is contingent on the approval of the prime (coastal) route. It leaves the coastal route (as filed) near Shingle Point and runs north across Shallow Bay (dual pipe) to the southern end of Langley Island. South of Taglu and Parsons Lake, it would follow the prime route past Inuvik then a direct route east of Travailant Lake to join the prime route at Thunder River. Mr. Dau indicated that this route would be about \$100 million cheaper than going around the Delta as now filed. In cross-examination he agreed that from an engineering perspective, the Cross Delta Alternative would be the 'prime route'. Vol. XVIII pages 2032 to 2034

A. Technical/Engineering (Cont'd.)TRANSCRIPT REFERENCE

- The Commissioner expressed an interest in how the Cross Delta route was decided on and how, in view of the Pipeline Guidelines reference to Fort MacPherson, such a route could be considered in the specified corridors. Vol. XVI pages 1869 to 1874
- The Alternative 42 inch Dempster Supply Lines Supplement to carry Alaskan and Delta gas from the source to the 48 inch pipeline at Travaillant Lake, was filed with the Inquiry. Vol. XVI p. 1745
Vol. XVIII
1875 to 1877
 - Foothills cross-examination pointed out that if all compressor stations were built as shown, two 48" diameter pipelines would be required from Travaillant Lake to Caroline. Vol. XVI pages 1804 to 1806
 - The routing of the pipeline was affected by the ownership of the operating company and by political and regulatory forces according to Foothills. No consideration was given to existing facilities south of 60. Vol. XVI pages 1759 to 1770
 - The ultimate decision on the Coastal (prime) vs. Interior Routes would be made in the United States by the Federal Power Commission according to Mr. Dau in cross-examination by Foothills. Although the total cost of the interior route is \$525 million more than the total cost of the coastal route, the Canadian portion of the interior route actually cost \$25 million less than the Coastal route in Canada. Vol. XVI page 1778
Vol. XVII pages 1877 to 1878
 - The location of the Mackenzie Valley Highway and its influence on the routing of the pipeline was pursued by CARC. Vol. XVI pages 1850 to 1853
 - The 120 ft. right of way would have to be increased by 20 ft. for looping but no studies had been done to determine the effect 2 large-diameter chilled pipes would have when close together as in looping, according to Mr. Dau in cross-examination by CARC and COPE. Vol. XVIII page 1858
Vol. XVIII pages 2037 to 2040
 - Northern Engineering Service agreed to keep all participants advised of all major and minor route location changes as they are being studied. In general, amendments would be filed only if the routing was changed to a position not shown on the alignment sheets as filed. Vol. XVIII pages 2082 to 2091

B. Environmental

- Route changes based on environmental concerns were made by NES according to Mr. Dau. The relocation at Travaillant Lake to avoid an ecologically sensitive area was used as an example. Vol. XV page 1716 and 1723

B. Environmental (Cont'd.)TRANSCRIPT REFERENCE

- To establish the influence of environmentalists in route selection Commission Counsel in cross-examination, requested: 1. The proposed routing at the time the environmental consultants were engaged and, 2. a copy of the proceedings of the April 1973 seminar at which the environmental route change tradeoffs were made. Vol. XVIII pages 2077 to 2082
- Commission Counsel in cross-examination clarified NES role in making environmental decisions as follows:
 1. NES was the final judge on whether the environmental consultants would have their way or not.
 2. NES had no scale of priorities, values and no guidelines with which to make environmental-engineering tradeoffs.
 3. NES was making "impossible" decisions which, as in the case of choosing a coastal route, left even the competing environmental concerns unresolved by a route compromise that didn't satisfy either.
 Vol. XVIII pages 2093 to 2104

C. Socio-Economic

- The absence of any socio-economic studies influencing the selection of the pipeline route was emphasized by the Indian Brotherhood in cross-examination. Socio-economic factors had no influence. Vol. XVII pages 1910 to 1916 1920 to 1923
- The determination of the "appropriate" distance between settlements and the pipeline was questioned by the Indian Brotherhood and COPE in cross-examination. It remained unresolved. No satisfactory explanation could be provided by the panel. Vol. XVII pages 1916, 1917 and 1950 to 1956
- Indian Brotherhood in cross-examination established that despite possession of a report on the existence of registered traplines on the proposed route, none of the trappers had been notified. Note the Commissioner's summation on this point on page 1944. Vol. XVII pages 1931 to 1944
- Commission Counsel in cross-examination questioned the validity of the statement in the Fort Simpson Amendment that the new routing would have the same socio-economic impact as the original routing. The panel agreed this seemed unlikely. Vol. XVIII pages 2110 to 2120

D. Miscellaneous

- Three new reports were submitted by CAGPL in addition to the amendments and alternatives above: 1. Drainage and Erosion Control. 2. Draft Interim Report on Results from Frost Effects Study. 3. Supplemental Hydrology. Vol. XVI page 1746

D. Miscellaneous (cont'd)TRANSCRIPT REFERENCE

- The background of Northern Engineering Services and its relationship to CAGPL and other companies was presented by Mr. Dau 'in Chief' and in cross-examination by Foothills. Vol. XV pages 1648 to 1653, Vol. X pages 1749 to 1755
- Participants expressed concern over the continual flow of amendments/ alternatives of major significance. CAGPL agreed that delays in this Inquiry resulting from this indecision are their sole responsibility and public statements will not be made blaming the Government or the Inquiry. Vol. XVII pages 1879 to 1886
- An attempt by Foothills to have CAGPL file documents on Financing and Cost of Service was rejected by CAGPL on the grounds that they are not relevant to the Inquiry. They are already filed before the NEB and are available to the participants. Vol. XV pages 1615 to 1627 Vol. XVI page 1747

E. Inquiry Schedule

The next panel on the "Geotechnical Aspects of Engineering Design and Ancillary Facilities" will appear March 17th to 21st and then resume after the recess on April 7th until cross-examination is complete. The panel consists of:

J.T. Clark
 N.R. Morgenstern
 R.H. Cooper
 R.M. Hardy
 W.A. Slusarchuk
 G.W. Hollingshead
 E.C. McRoberts
 G.L. Williams

Informal community hearings will be held in Aklavik from April 2nd to 4th.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. XIX TO XXIX)

ARCTIC GAS
 GEOTECHNICAL ASPECTS OF ENGINEERING
DESIGN OF THE PIPELINE AND ANCILLARY FACILITIES

YELLOWKNIFE, N.W.T.

MARCH 17-21 and APRIL 7-14, 1975

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TOPIC: Phase 1; Engineering and Construction of Proposed Pipeline.

Panel on: Geotechnical Aspects of Engineering Design
of the Pipeline and Ancillary Facilities

DATE: March 17 to 21 and April 7 to 14 in Yellowknife

WITNESSES: Panel on Geotechnical Aspects of Engineering Design
of the Pipeline and Ancillary Facilities.

- Dr. J.I. Clark: Supervisor of Geotechnical and Environment Studies, Northern Engineering Services Co. Ltd. (NES)
- Dr. G.W. Hollingshead: Manager of River Engineering, NES.
- Dr. E.C. McRoberts: Senior Geotechnical Engineer, NES.
- Dr. W.A. Slusarchuk: Manager of Geotechnical and Geothermal Studies, NES.
- Dr. N.R. Morgenstern: Professor University of Alberta and Consultant.
- Dr. R.H. Cooper: Consultant in Hydrology, River Engineering and Hydraulic Model Testing.
- Dr. R.M. Hardy: Pres. R.M. Hardy and Associates, Geotechnical Consultants.
- Mr. G.L. Williams: Director of Field Services, NES.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 General

- Geotechnical studies embrace the fields of soil mechanics, rock mechanics and the engineering aspects of geology, geophysics, hydrology and related sciences. Geothermal studies are directed toward analysing and predicting temperatures in the ground and changes to these temperatures resulting from construction according to definitions provided by Dr. Clark. Vol. XIX
2167-2170
- Geotechnical/geothermal considerations included, according to Dr. Clark, verification of terrain typing, and analysis of slopes, permafrost (ground thermal regime), rivers, surface and subsurface drainage, and soils along the route. Vol. XIX
2170-2173
2177-2185
2219-2222
- The initial objective was to establish performance criteria rather than design criteria. Solutions to northern pipelining problems such as frost heave, slope stability, pipe floatation, buried river crossings, building and pipeline foundations in permafrost, protection of ground thermal regime, icings, permafrost excavation etc. have been proposed with the objective of proceeding with detailed designs to maximize human safety, minimize disruptions to the environment and secure a reliable pipeline system. Vol. XIX-A
2227-2240
2258-2272
2275-2278

a. Technical/Engineering (Cont'd)TRANSCRIPT
REFERENCE

- Additional work which must be conducted by NES prior to construction, according to Dr. Clark, includes verification of river crossing design data, ground truthing selected portions of the right of way, preparation of orthophotomosaic alignment sheets, and preparation of detailed designs and construction specifications. As part of the design process, a 'Design Manual' will be prepared for the design engineers covering design criteria for pipeline anchoring and curvature, foundations, slopes, etc. After final design, a 'Design Change Manual' will be prepared to assist field engineers in overcoming unforeseen field conditions revealed during construction

Vol. XIX-A
2241-2250

Vol XXIX
3619-3622
 - During construction a catalogue of permafrost and soil conditions will be developed on a mile by mile basis. Dr. Clark indicated that this catalogue along with information on hydrology, river morphology, ice jams, drainage and erosion, etc. will form a data base for use in the operation and maintenance of the pipeline.

Vol. XXIV
2871-2875
 - In building the pipeline, the design engineers will be responsible for design implementation along with a trained inspection staff according to Dr. Clark. These people will report to Arctic Gas via Northern Engineering Services. The staffing and reporting concept is currently under study by the board of directors of Northern Engineering although no direction has been given by Arctic Gas. It was confirmed that qualified geotechnical engineers will be on site during construction and these engineers will be responsible for any construction design modifications.

Vol. XIX-A
2251-2257

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3622-3631
- a-2 General Design
- This will be the only 48 inch high pressure chilled gas pipeline according to Dr. Clark, in cross-examination by Foothills, although there are 259 miles of 48" oil pipeline in Canada and the U.S.A.

Vol. XIX-A
2253-2254
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2498-2500
Vol. XXII 2530
 - The 48 inch feeder lines from the gas source to Travaillant Lake (as filed) would be used if the reserve forecast is proven correct. If reserves are less, the 42 inch line alternative would be built. Similarly, any decision to loop the lines would be based on supply and demand with the likelihood of looping being greater for a 42" line. This information along with the fact that there have been no studies on looping, was obtained by COPE in cross-examination.

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a-2 General Design (Cont'd)TRANSCRIPT
REFERENCE

- The knowledge is available to build a chilled pipeline in permafrost according to Dr. Clark in cross-examination by commission counsel. The 'tools' available to do this are: 1. a knowledge of standard pipeline practice, 2. a core of well qualified experts, 3. data obtained from test sites and 4. an ability to make geothermal predictions (computer program). Present efforts are directed at optimizing (making less expensive) the conservative design as now proposed. All of the panel felt that the techniques now available to them were sufficient to design and build this unique pipeline. Vol. XXIV-A
2885-2897
- The decision to chill the gas, according to the cross-examination by commission counsel, was made in late 1972 mainly for environmental and pipeline integrity reasons. The panel knew of no economic advantages in throughput leading to a chilled gas decision. The decision to chill the gas to the Alberta border could be changed to a point further north in the final design considerations. Vol. XXVI
3214-3223
- Advantages of placing the pipe on piles would be offset by new problems associated with elevated pipelines according to Dr. Clark in cross-examination by the N.W.T. Indian Brotherhood. Subsequent cross-examination by commission counsel pointed out the lack of information on the elevated portions of the test facility at Sans Sault. Mr. Williams indicated that this was because nothing worthwhile happened except the deterioration of the pipeline coating. NES had Soviet literature translated and had some information based on studies in Alaska but a comparative buried/elevated report is not available for this project. It was pointed out by Dr. Hardy that Soviet experience is not for buried or chilled pipelines and Canadian conditions are quite different from an engineering viewpoint. Vol. XXIV
2768-2778
- The coastal route is preferable geotechnically to the interior route according to Dr. Clark. Although there is some seismic risk on the interior route, it can be overcome by special trench designs utilizing granular backfill and sloping trench walls according to the panel in response to Foothills questions. Vol. XIX
2173-2177
2225-2226
Vol. XIX-A
2277- 2284
Vol. XIX-A
2278-2283
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2490-2498

a-3 Test Facilities

- The total cost of test facility related studies was about \$9 million according to the panel. Although there were four test sites at Prudhoe Bay, Norman Wells, Sans Sault and Calgary, the latter two were the main ones used to verify the chilled gas concept, the construction feasibility, the analytical programs and the right of way restoration techniques. The Prudhoe Vol. XIX
2194-2218
2222

a-3 Test Facilities (Cont'd)TRANSCRIPT
REFERENCE

- Bay facility was built in March 1971, the Norman Wells facility in April 1971, the Sans Sault facility in January 1971 and the Calgary facility in March 1974. Vol. XXVII
3282
- The details of the selection and results of the Sans Sault test site were pursued in cross-examination by commission counsel. The site for the facility was selected in 1970 on the basis of about 750 drill holes along the Mackenzie corridor and on the basis of terrain typing done by J.D. Mollard and Associates for the Northwest Project and Mackenzie Valley consortiums. The site selected was one of six sites recommended by Mollard. It was in continuous permafrost in terrain types HT, DL and GLB. According to Mr. Williams, Dr. Mollard cross-sectional logs of these types of terrain, show that the site tends toward the most difficult of soils to be found along the route even though the HT classification is represented on less than 1% of the right-of-way. Vol. XXVII
3566-3567
- The Calgary Test Facility was described initially by Dr. Slusarchuk. It consisted of a chilled section of pipe in frost susceptible soils with a high water table. A control section was placed with 2½ ft. of cover, a deep burial section with 5½ ft. of cover, a gravel section with the frost susceptible soil replaced with gravel for 3 ft. under the pipe, and restrained section was built with a mechanism to hold a load on the pipe. Laboratory soils tests were also conducted to test the heaving characteristics of soils selected from along the pipeline right-of-way. Laboratory Model tests using a 4 inch pipe in frost susceptible soils were also conducted. These studies indicated that the rate of heave of a freezing soil is significantly reduced as the load on the frost front (32° F isotherm) increases. The load on the soil at which, upon freezing, water is not drawn into the soil to grow ice lenses and at the same instant is not expelled, is called the shut-off pressure. At loads greater than the shut-off pressure, some local water is expelled away from the freezing front. Therefore, by increasing the load on the pipe by deep burial (more overburden pressure) or by building a berm above the ground surface over the pipe, frost heave can be reduced and the buried chilled pipeline can be safely operated. Vol. XX
2312-2344
- A brief history of frost heave work and a view that the Calgary test did represent a 'worst case' was given by Dr. Hardy in Vol. XXI
2562-2572

a-3 Test Facilities (Cont'd)

cross-examination by CARC. The view was expressed that the Calgary studies were of the highest quality in a scientific sense.

- The significance of the Calgary tests was questioned by commission counsel in cross-examination. The test was not designed to simulate differential heave which is of greatest concern in protecting pipeline integrity. The soil was of only one 'terrain type' and the test results are limited to one year thus requiring extrapolations to the life of the pipeline. The panel did not agree that these were significant limiting factors. Also deemed of some importance in considering the rate of frost heave was the availability of a higher water table or artesian water conditions.
- The stress history of the soils tested as part of the Calgary research were not considered separately since the undisturbed samples tested included the effects of stress history with respect to freezing behavior. The stress history is not critical according to Dr. Morgenstern and Slusarchuk.
- The appearance of surface cracks along the heave shear plane at the Calgary test site was acknowledged by Dr. Slusarchuk in cross-examination by commission counsel. The cross-examination pointed out the possible effects of these cracks on surface drainage.

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a-4 Frost Heave

- Frost heave is not a problem for a chilled pipeline in continuous permafrost according to evidence led by Dr. Clark. The rate of water migration in frozen ground is so low that a total heave of only a few inches would occur over the life of the pipeline. Water moves from warmer to colder permafrost according to 'Gibbs Free Energy Law' according to Dr. Slusarchuk in cross-examination. Work has been done by NES on this subject but it has not been published.
- Frost heave problems occur in freezing previously unfrozen ground where there is a soil with a high cut-off pressure and water is available. The Calgary test facility (see a-3) was designed to provide assurance that such heave could be reduced by: (1) deep burial, (2) surcharging the ground above, (3) replacing frost susceptible soils

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a-4 Frost Heave (Cont'd)TRANSCRIPT
REFERENCE

- and (4) reducing heat flows by insulating. The use of chemical grouts to inhibit water migration is generally not a practical frost heave solution according to Dr. Hardy.
- Frost heave problems are of two general types, total heave and differential heave, according to Dr. Clark. The object in combating total heave is to keep the top of the pipe at least one foot below the ground surface. In the case of differential heave, the difference must be kept below the serviceable radius of curvature of the pipe which, in the case of the CAGPL pipe, is $2\frac{1}{2}$ to 4 feet in 100 to 150 feet. The critical area for differential heave is at the frozen unfrozen interface of two soils (before the chilled pipeline goes into operation). If the force required to lift the pipeline is equal to or greater than the shut-off pressure of the soil, water will not form lenses and the heave problems will be minimized.
 - Frost heave quantification, according to cross-examination by commission counsel, are based on: (1) lab tests such as those done at the Calgary facility, (2) terrain typing, (3) geothermal analysis and (4) drill holes along the route. The route frost heave quantification is limited to terrain typing but there will be more drilling to expand on this according to Dr. Slusarchuk.
 - The limitations of traditional measures of frost susceptibility such as the TRRL and CRREL techniques were emphasized by Dr. Slusarchuk in cross-examination. He pointed out that these measures were developed for low overburden pressure conditions such as roads and airstrips. This classification does not apply to the Arctic Gas pipeline where there is a substantial overburden pressure. By traditional measures, the Calgary silt is very frost susceptible but if the overburden pressure is considered, it is not frost susceptible because of its low shut-off pressure. Other properties which are important are grain size and rate of freezing - both as it affects ice lens formation and, if the rate is different from place to place, as it affects differential heave. When the 'cut-off pressure' (see definition in a-3) is reached, lensing and hence heaving terminates. The depth of burial or surcharge is the key factor in achieving the cut-off pressure.
 - The existence of icy sediments at depths of up to 140 feet was noted by commission counsel in reference to a publication by

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3187-3208

a-4 Frost Heave (Cont'd)TRANSCRIPT
REFERENCE

- Dr. McKay. Although the shut-off pressure theory indicates that this type formation shouldn't exist, Dr. Morgenstern postulated that the formation could be explained by other theories not necessarily contradictory to the theory of shut-off pressures. There is no general agreement among geotechnical people on these other theories. It was suggested by commission counsel that these formations may be long term effects not foreseen by the short duration test conducted at Calgary.
- An example of a differential heave situation was presented by commission counsel. By showing a speckled bog in cross-section, it was illustrated that detailed knowledge of soil conditions along the route would be required to implement remedies to potential differential heave situations. The panel emphasized that heave did not have to be eliminated completely but only controlled within limits. Additional bore holes along with geophysical techniques now under study will be relied on to provide the details of subsurface soil conditions.
 - Approximately 200 miles of the proposed pipeline right-of-way passes through areas of potential frost heave problems - primarily from Willow Lake River to the Alberta border - according to Dr. Slusarchuk in cross-examination by commission counsel. The panel was unable to provide frost heave predictions on a mile by mile basis although areas with various heaving characteristics could be identified according to terrain type on the route. This has not yet been done. In a 'worst case' situation, the total heave could be as much as 6 ft. in the first 6 to 10 years with the most heaving occurring in the first 4 to 5 years. This total heave would not necessarily translate into differential heave to stress the pipe. Vol. XXVI
3129-3150
 - The interaction between a chilled pipe and the surrounding soils when crossing on ice wedge at approximate right angles was described by Dr. McRoberts. He disagreed with a report that suggests the ice wedge pressures would deform the pipe. Vol. XXVII
3427-3435
 - The main measures to minimize frost heave according to Dr. Slusarchuk are: (1) deep bury, (2) surcharging, (3) replacing frost susceptible soils, (4) insulating the pipe and (5) alternating the flow at dual river crossings. The first two techniques will be used most commonly. Frost susceptible Vol. XXIX
3631-3635
 - Vol. XXVI
3223-3227
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2712-2714

a-4 Frost Heave (Cont'd)TRANSCRIPT
REFERENCE

soil replacement could occur at compressor stations where the pipe comes above ground. Insulating will be used to minimize the size of the frost bulb under small rivers which have a granular base containing sub-bed flow or which have frost susceptible soils within the zone of influence of the frost bulb. Alteration of flow would be used on major river crossings such as the Cross-Delta route according to Dr. Slusarchuk in cross-examination. Although no tests have been done, he suggested that this technique would reduce heave by minimizing the size of the frost bulb.

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3228-3231

- Monitoring of pipeline heave, although not finalized, could be based on: (1) pipe riser rods such as were used at the Sans Sault test site, (2) pigging techniques or, (3) geophysical methods. The method will be finalized when the Design Manual is produced.

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3209-3214

a-5 Frost Bulb

- The two geothermal computer programs used to predict the rate of thaw and the rate of freezing at various depths are the EPR and Battell-Brooker programs according to Dr. Slusarchuk in cross-examination. Recognizing that the programs are only as accurate as the input data, commission counsel pursued the probable error in the greenhouse factor input parameter, its method of determination and the program sensitivity to variations within its probable error. The 'worst likely circumstance' concept for input data was not used. Dr. Slusarchuk noted the confidence of the program in predicting temperatures at the Sans Sault test facility and expressed his satisfaction, from an engineering viewpoint, with the programs capability. The commissioner pursued the point made by commission counsel, that the predictions at Sans Sault were in fact made after the field results were known.

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3376-3427

- A general clarification of frost susceptibility and frost bulb growth was given by Drs Hardy and Morgenstern in cross-examination by CARC. Generally, the frost bulb would grow at an ever decreasing rate. After 10 years, it would probably be about 20 feet below the pipe.
- The effect of convection on the frost bulb was outlined by Dr. Clark with reference to questions raised by the Pipeline Assessment Group. Convection reduces the size of the frost bulb and displaces it in the direction of the (heat) flow. The computer program can predict this phenomena and therefore,

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a-5 Frost Bulb (Cont'd)TRANSCRIPT
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- icing or sub-surface flow design measures can be taken.
- The frost bulb varies in size and quality (strength) in different soil types according to Dr. Slusarchuk in reference to the Speckled Bog example presented by commission counsel. The example as presented, would produce a differential heave situation which could produce forces that would flex the pipe. It was suggested by commission counsel that the flex would be non-uniform, according to the variations in frost bulb strength, and stress would in fact be concentrated at the weaker parts of the soil and the pipe at those points. Dr. Morgenstern noted that the pressures would be limited by the capacity of the unfrozen soil to transmit the forces although non-uniform stress concentration could occur.

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3179-3186

a-6 River Flow

- Few of the rivers and streams along the pipeline right-of-way are gauged according to Dr. Cooper in cross-examination by COPE. Stream flow is not as critical in buried pipeline crossings as it is for designing dams and bridges. As a part of final design, a stream by stream assessment will be made.
- The design flow used for preliminary design on the Mackenzie River was the 100 year flood. On other streams and rivers, a figure based on the maximum recorded flood was used. Dr. Cooper explained that there was a 95% level of confidence in predicting a 100 year flood from the 25 years of data available for the Mackenzie and there was no particular advantage in using the 'standard project flood' concept such as was used in Alaska. In the case of a braided rivers such as the Firth, the largest channel is selected and an assumption is made that it would meet with another. The total confluence flow may only be 20 to 30% of the total flow but it would be the most severe for scour calculations.

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a-7 River Channel Shift

- The rate of river meander shift is variable according to Dr. Hollingshead. It varies from year to year and place to place in the river and predictions are often not easily made since conditions often build up gradually.

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3030-3042

a-7 River Channel Shift (Cont'd)TRANSCRIPT
REFERENCE

- The location of the Swimming Point crossing was choosen, in part, because of the stability of the banks according to Dr. Hollingshead. A report by Dr. Morgenstern suggesting that the river channel shape might support rapid change was placed in perspective by the author.
- The report that the future flow in the Delta could shift from the Middle to the East Channel was given its proper geologic time frame by the panel and it was proposed that this was not a major factor in design.
- Changes in river channels could occur on any river and in particular on the North Slope rivers. Pipeline crossings for these rivers will be designed on the assumption that changes will occur.

a-8 Scour and Ice Gouging

- A general outline of vertical and horizontal scour in open water and ice jam conditions on single and braided river channels was given by Dr. Cooper. Ice jam scour could be up to 30 feet at a location such as Point Separation which has a high flow velocity, a sand bed and a large amount of ice. The designs to date are conservative and the on-going work is to achieve more economical designs. Vol. XXI
2442-2472
- Recent Alaskan studies, according to evidence led by Dr. Clark, show that scour and channel migration can be predicted at braided and major rivers. The general solution is to bury the pipe deep, keep the sag points well back into the bank and, in the case of braided rivers, control the channels with river training structures. Vol. XX
2395-2402
- An outline of the history of scour designs on pipelines in Canada was provided by Dr. Hardy in response to cross-examination by Foothills. In response to COPE, Dr. Hardy pointed out that Canadian expertise on these matters is better than anywhere on this continent and although the approach is not satisfactory from a scientific viewpoint, the engineering procedures are proven and he is confident in them. Vol. XXIV
2836-2842
- The effect on scour of surface icing concentrated flow caused by a chilled pipeline under a river was questioned by CARC. Dr. Cooper explained this was not a critical scour condition. Vol. XXII
2625-2638
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a-8 Scour and Ice Gouging (Cont'd)TRANSCRIPT
REFERENCE

- Dual river crossings are not proposed because of scour, according to Dr. Cooper. Work done since his 1974 report for NES on River Breakup has shown that scour can be predicted and therefore his statement in that report, that dual crossings should be contemplated because of scour unpredictability, is now invalid. Vol. XXII
2643-2650
- The scour formula used by Dr. Cooper was questioned by commission counsel. He conceded that other formulas did exist and a certain amount of judgement was required in selecting coefficients in his formula. An alternative formula from a reference text put forward by commission counsel was deemed by Dr. Cooper to be essentially the same as his own. Vol. XXV
3024-3030
3034-3035
- Gouging by ice cakes will be most severe along the banks rather than in the channel according to Dr. Cooper. This is because the cakes float in the deeper portions of the river and hence won't gouge the river bed. Responding to examples of river crossings along the route as chosen by commission counsel, Dr. Cooper pointed out that, at the banks, where gouging would be greatest, the pipe cover was sufficient to prevent pipe damage by gouging. Vol. XXVI
3103-3113
- Although ice cake gouging in the Beaufort Sea has been up to 30 feet, a calculation of the largest possible cake on the Mackenzie shows a possible gouge of only 7 to 8 feet. As pointed out by Dr. Cooper, although this is an untested hypotheses, it is not a critical design concern when compared to open water and ice jam scour. Vol. XXV
2991-3000
- The existence of deep holes in river channels of the Mackenzie and possibly other rivers was confirmed by Dr. Cooper in cross-examination. Some of these holes are up to 100 feet deep. The origin of these holes is unknown although it was postulated that they were due to thermal degradation of massive ice in the river beds or perhaps due to reversing flow in the river. Commission counsel suggested that the holes posed a risk to the pipeline if they developed at the river crossing site. Vol. XXV
2980-2990
- A report describing a bridge in Siberia being sheared off by ice moving under pressure was referred to by commission counsel. The report also described an icing which 'exploded'. The panel suggested that this was an unusual occurrence upon which it would be difficult to comment without more detailed information. Vol. XXVIII
3465-3471

a-9 River CrossingsTRANSCRIPT
REFERENCE

- The question of overhead versus buried river crossings was raised by CARC and COPE and Commission Counsel. Dr. Hardy, in response, said that, although somewhat controversial, experience by owners and operations of other pipelines show that buried crossings are superior. Overhead crossings were never really considered viable on this pipeline. They lead to problems of security and maintenance. The report by Lamb on overhead crossings of the Mackenzie did suggest that they were viable from a structural engineering viewpoint. Problems of scour would not be eliminated by crossing overhead since many such crossings would require piers in the river which would be subject to scour. Vol. XXII
2650-2670
Vol. XXIV
2817-2819
- Of the 650 (approximately) river crossings, about 150 would be given individual attention and the balance would be treated with a typical design, according to Dr. Hollingshead. Vol. XXI
2441-2442
- The Bear River crossing was presented by Dr. Hollingshead as an example showing a minimum 10 ft. cover in the channel, a construction berm on a shallow portion of the river and a slope stabilization berm. Using this and other examples, Dr. Hollingshead pointed out the major considerations were: (1) vertical erosion, (2) horizontal erosion, (3) pipe floatation, (4) general bed degradation (scour) and (5) river channel shift. The key points in a design are: (1) to keep the pipe below the lowest bed level and (2) to keep the sag point sufficiently protected in the river bank. Vol. XXI
2421-2426
Vol. XXI
2427-2439
- There is no permafrost beneath the beds of the Peel River, the Swimming Point the Point Separation crossing and the Great Bear Crossing according to Dr. Clark and Dr. Hollingshead. Cross-examination by commission counsel indicated that the drill holes were often not taken to below the pipeline burial depth and in some cases did show some frozen material. Some of the holes were located on the banks and in the example cited there was no hole below the deepest (sag) point of the pipe. A 'hole' shown on one drawing could be explained by open water hydraulics and is not unusual, according to Dr. Cooper. Vol. XX
2364
Vol. XXVI
3091-3103
Vol. XXVII
3278
- There is permafrost at some depth under all the North Slope rivers (except the Mackenzie) according to Dr. Cooper in response to commission counsels cross-examination. Counsel presented an example of a typical small channel Vol. XXVIII
3436-3445

a-9 River Crossing (Cont'd)TRANSCRIPT
REFERENCE

crossing where the water would freeze to the bottom and the frost bulb could intercept sub bed flow. Dr. Cooper agreed that in such a case, the freezing of the aquifer would build up pressures and the water would surface upstream of the pipeline crossing causing an icing. To evaluate the extend of such a problem along the route, additional bore holes, geophysical and recognizance are being planned.

- The excavation of the bank of a river crossing was clarified by Mr. Williams for COPE. Using the Willow River as an example, he explained the probable excavation techniques pointing out that a 40 foot excavation, as shown, was not uncommon. Most river crossings would be built and backfilled in the winter. Vol. XXIV
2847-2849
- Major damage to a river crossing would take 30 to 150 days to repair in a 'worst case' situation, according to Mr. Williams, although temporary remedial measures might be employed to restore service more quickly. Vol. XXIV
2875-2876
- Major damage to a river crossing would take 30 to 150 days to repair in a 'worst case' situation, according to Mr. Williams, although temporary remedial measures might be employed to restore service more quickly. Vol. XXV
3060-3062

a-10 Slope Stability

- An overview of slope stability was led by Dr. Morgenstern. There are three main classes of slope failure: (1) flow, (2) slide and (3) fall each of which has subgroups. These were illustrated with slides including examples of highway cuts in permafrost on the Alaska pipeline haul road and the Dempster Highway. Recognizing that slope stabilization techniques are numerous and generally site specific, example techniques presented were: (1) insulation sandwich with a surcharge, (2) internal drainage, (3) use of vertical cuts so that the collapsed overhang acts as insulation and (4) revegetation. The Bear River crossing was presented as an example of stabilization by surcharging the toe of a slope. Vol. XX
2345-2359
- Only two to three percent of the route is potentially unstable and further study is expected to reduce this figure according to Dr. Clark. Talus slopes on the interior route would require special care in design and would be difficult to excavate. Vol. XX
2365-2373
- The coefficient of consolidation (Cv) factor of safety increases in a thawed ice rich soil sample. The reason for this was explained in detail by Dr. Morgenstern. Vol. XIX-A
2284-2289
- Creep would not be a significant factor in permafrost according to Dr. Clark and Dr. Morgenstern. If it did pose a Vol. XX
2415-2420
- Creep would not be a significant factor in permafrost according to Dr. Clark and Dr. Morgenstern. If it did pose a Vol. XX
2382-2384

a-10 Slope Stability (Cont'd)TRANSCRIPT
REFERENCE

- problem, mechanical separating techniques would be used between the creeping soil and the pipe.
- The general principles of locating valley and river crossing were outlined by Dr. Clark in response to a point in the Pipeline Assessment Group report. Vol. XX
2403-2405
 - Erosion control by using ditch plugs and surface dikes would be incorporated in the design according to cross-examination by COPE. Although this would decrease the erosion, Dr. Clark acknowledged that plugs could cause localized pooling of subsurface water which would freeze. Although not field tested in permafrost this was not considered a problem. Vol. XXIV
2819-2828
 - Although the quantitative aspects of slope stability analysis are only recently understood, Dr. Morgenstern expressed confidence in the solutions proposed. Alaskan experience and solutions in non permafrost areas along with more site specific information will be used in finalizing design. Generally, slopes which will be subject to individual analysis will be those that are: (1) steep and high, (2) in unstable terrain types, (3) marginally stable, (4) in environmentally sensitive areas and (5) those that would be critical if they failed. The sandwich technique of stabilization was described in detail and it was pointed out that monitoring after construction would play an important role. It was also noted that a chilled pipeline increases the stability of a slope through which it passes. Problems caused by drainage could be dealt with in the conventional ways since they are often similar to southern situations. Vol. XXVIII
3501-3559

a-11 Blasting

- Blasting of ice janes may be considered in critical situations although it is not an alternative relied on in the design of river crossings according to the panel. Vol. XXV
3049
- Some blasting will be required for trenching and techniques are known according to Mr. Williams in cross-examination by the N.W.T. Indian Brotherhood. A small amount of research has been done on blasting non rock permafrost. Generally 3-inch holes will be lightly loaded in a 5 foot square dice pattern. This should limit the throw to less than 5%. Vol. XXIII
2754-2758
- Details of the location of blasting by terrain type were presented as an exhibit by Mr. Williams. Vol. XXIX
3565-3566

a-12 Backfill and Pipe StabilityTRANSCRIPT
REFERENCE

- Estimates of granular fill requirements seem to be under estimated according to cross-examination by the Environmental Protection Board. The panel pointed out that estimates were based on a 30% contingency, and in the Bear River crossing example, the estimate was realistic. Reference was made to the governments study on gravel quantity and quality study for the Mackenzie area.
Vol. XXIII
2674-2683
- Excavated material not used for backfill will be spread on the surface or taken to a disposal site such as a quarry according to cross-examination by COPE. It will be dealt with on a site specific basis. There are no plans to process excavated material to selected backfill requirements.
Vol. XXIV
2844-2847
- Buoyancy would exist or potentially exist along 44% of the route from Richards Island to the Alberta border according to commission counsel in cross-examination. Mr. Williams indicated that this problem would be solved by (1) deep bury, (2) berm surcharging, (3) concrete weights and (4) continuous concrete coating.
Vol. XXIX
3573-3577
- The forces developed at overbends, sidebends and sagbends were primarily due to the gas pressure in the pipe and thermal expansion of the pipe steel. These could be complemented by frost heave forces and buoyancy forces tending to push the pipe above ground. The frost forces would occur slowly and could be handled by surcharge, localized freezing or localized melting of ice lenses. Buoyancy, if it lifted the pipe above ground, could be remedied by cleaning out the trench and relaying the pipe. In other cases, it might be necessary to shut down and replace a segment of pipe.
Vol. XXIX
3583-3590
- Parts of the Pointed Mountain pipeline floated to the surface during the first years operation according to Dr. Hardy in cross-examination by commission counsel. These sections were up to 200 feet long and were due to insufficient lateral resistance of the muskeg or incorrectly centered weights.
Vol. XXIX
3568-3573

a-13 Routing

- The total prime route mileage affected by amendments and alternatives was
Vol. XXIII
2759

a-13 Routing (Cont'd)TRANSCRIPT
REFERENCE

supplied by the panel in response to a request by commission counsel. The Fort Simpson and Cross Delta changes affect 600 miles leaving 547 prime route miles unaffected, and 236 are affected by the Fort Simpson Amendment and 854 miles are unaffected.

- The Fort Simpson Route Amendment has no drill hole information except for some in the area done by previous pipeline consortia. Drilling is planned, according to Dr. Clark, but as of the amendment date, only terrain typing was available. Vol. XIX-A
2290-2292

- The Cross Delta Alternative alignment sheets and some supporting reports were filed. The geotechnical assessment, summer and winter soundings and some drilling has been done along with the preliminary design as filed. Vol. XXIII
2671
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2292
Vol. XXI
2508-2512
Vol. XXII
2638-2643

Cross-examination by Foothills revealed that the pipe will be 36 inch twin lines approximately 200 feet apart. Dr. Clark in cross-examination by CARC indicated that there is no permafrost on the route and the soil is frost susceptible but unconsolidated. Hence, by using deep burial and a gravel blanket, the shut-off pressure of the soil could be reached and frost heave problems minimized.

- The bore hole information shown on the Cross Delta Alternative was questioned in cross-examination by commission counsel. It became evident that the technique of sampling and the temperature data, where it existed, were only available by reference to other reports. Dr. Clark agreed to supply the total number of temperature probes on the route after contesting counsels count of only 22. The objective of the Shallow Bay drilling was to determine the permafrost depth. Only 3 holes were drilled in the Bay proper and no holes were drilled to depths below the pipeline depth of burial. More drilling is planned on this and other portions of the route with the spacing of the holes depending on the terrain variability. No general sampling interval could be given similar to the 5 holes per mile interval reported for the Mackenzie Valley Highway. Vol. XXIX
3590-3619
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2948

Bore hole data will be supplemented by geophysical surveys and ground reconnaissance.

a-14 Foundation

- There will be little foundation vibration caused by the turbines at compressor stations according to cross-examination by COPE. Most buildings will be on piles.

TRANSCRIPT
REFERENCE

Vol. XXIV
2861-2865

a-15 Design Risk

- The element of design risk inherent in various aspects of the geotechnical design was pursued by commission counsel's cross-examination. A paper entitled 'The Role of Calculated Risk in Earthwork and Foundation Engineering' was quoted suggesting two elements in design risk: (1) that based to imperfect knowledge and guided by judgement and (2) that based on a knowledge of the magnitude of the losses and incorporating a margin of safety. The panel was questioned on the degree of design risk inherent in the various aspects of their work but were reluctant to answer because of the disagreement on the interpretation of the meaning of the term 'risk'. The only risk analysis known was done for Arctic Gas by others who looked at the financial aspects of river crossing and the twinning of these crossings to minimize revenue loss risks.
- This pipeline is safer than any other pipeline because more time and money were spent analysing problems than on any previous project of this kind, according to Dr. Hardy. Only the size of the pipeline and related facilities raises new concerns and the research has been directed to diminish the risks of any unknowns.

Vol. XXIV-A
2897-2947

B. Environmental(b-1) General

- The geotechnical groups mandate within Northern Engineering Services Co. Ltd. included, in addition to engineering

Vol. XXIV-A
2878-2884

(b-1) General (Cont'd)TRANSCRIPT
REFERENCE

design, responsibilities for minimizing the adverse environmental and social impact wherever possible, according to Dr. Clark. In response to commission counsel's questions, it was agreed that this responsibility was beyond the scope of most geo-technical people working on more routine pipeline work. Problems of an environmental/social nature arising in this project were dealt with primarily by routing and design changes.

- Geotechnical-Environmental inter-relationships were considered in assessing borrow areas, re-habilitation schemes, river crossings and drainage and erosion control measures according to evidence led by Dr. Clark. Vol. XIX
2189-2193
- A chilled pipeline would cause the least environmental change in discontinuous permafrost and would cause the least change to the total ecosystems along the route according to Dr. Clark in response to questioning by the Environmental Protection Board. (EPB) Vol. XXIV
2694
2735-2738
- The problem of how to weigh the effects on birds etc. of engineering works was raised by the EPB. Dr. Clark indicated that this was a situation requiring a 'best judgement' to avoid major problems. Vol. XXIII
2704-2705
- Archeological sites uncovered during construction would require special procedures according to COPE. Dr. Clark was not aware of any such procedures and suggested that the question could best be answered during the environmental phase of the hearings. Vol. XXIII
2860-2861

(b-2) Routing

- Details of routing changes made for environmental reasons and transcripts of the April meeting at which environmental routing decisions were made, were filed with the Inquiry and discussed in part by Dr. Clark. Vol. XXIII
2671-2673
2719-2727
Vol. XXV
2949-2964
- Thirty-one routing changes were considered of which thirteen were at the direct suggestion of environmentalists. Six environmental changes were ultimately made.
- Interdisciplinary field recognizance trips were not formally reported on according to cross-examination of the panel by COPE. Field notes may be Vol. XXIV
2865-2871

TRANSCRIPT
REFERENCE

(b-2) Routing

condensed into a report sometime in the future however. The environmental consultants participating in such activities were listed.

- The Fort Simpson Amendment was questioned by Foothills. Dr. Clark could think of no reason that the route couldn't go around the Ebbutt Hills area rather than over it as proposed. Foothills indicated that the Ebbutt Hills area had been designated as a possible site under the International Biological Program. The panel was not aware of this. Vol. XXII
2541-2547
- Environmentalists had an input from the start of the consideration of the Fort Simpson Amendment according to Dr. Clark. The Environmental Protection Board questioned the adequacy of the environmental impact part of the amendments as filed. Vol. XXIII
2705-2716

(b-3) Frost Bulb

- The effects of the frost bulb on erosion, pore water pressure and restoration of the right-of-way was introduced by the Environmental Protection Board (EPB) in cross-examination. Vol. XXIII
2716-2719
- The effect of two adjacent frost bulbs in a looping situation was not studied according to Dr. Slusarchuk in cross-examination by COPE. A single bulb would affect a 20 foot area on each side of a single pipeline thus limiting the effects to the right-of-way. Vol. XXIV
2789-2793
- The potential surface settlement along the route can be predicted using the computer program according to Dr. Slusarchuk but there is no report or test site field measurements to verify the accuracy of the predictions. A general body of knowledge exists, according to the witness, making predictions of such occurrences relatively routine. Vol. XXVII
3310-3314
- The heaving of the soils above and beside the pipeline was measured at the Calgary test site and Arctic Gas agreed to provide this information to commission counsel. The heaving would be greatest during the first few months with an equilibrium established after the start-up of the pipeline. Vol. XXVIII
3254-3263

(b-4) Surcharge Berm

- The environmental impact of the berm and the source of the berm materials was not adequately described in the impact assessment according to the EPB cross- Vol. XXIII
2683-2694

(b-4) Surcharge Berm (Cont'd)TRANSCRIPT
REFERENCE

examination. The surcharge berm could be up to five feet high but would more commonly be 2 to 3 feet and its effects would be similar to the trench spoil mound according to the panel. The areas requiring a surcharge have not been exactly identified.

- There is a potential for berm surcharging over 200 miles of the route although deep burial might be used to achieve the same result according to cross-examination by COPE. A five foot high berm (maximum size) would have a 50 foot wide base. Its effect on animal movement was not known to this panel. The use of gabions (rock filled wire nets) would be used for special erosion control or river training schemes where suitable gravel was not available. The wire net size is sufficiently large to prevent animals from getting their feet caught according to Dr. Clark.
- The down slope 'shadow effect' of a berm could develop different patterns of plant communities which would cause a larger frost bulb growth on the dry side. This could also influence the active layer but it would not result in any special heave problems according to Dr. Slusarchuk in cross-examination by COPE.

Vol. XXIV
2793-2799

(b-5) Surface Drainage

- A minimum culvert size on roads in Alaska at Prudhoe Bay was 48 inches and is now larger according to EPB.
- Surface drainage would be handled by (1) diversionary dikes, (2) backfill mound breaks, (3) granular mound caps or gabions and (4) impervious plugs, according to Dr. Clark in response to a question in the Assessment Group report.
- The effectiveness of the berm break in the early spring when it may be blocked by snow or plugged with ice was questioned by CARC. The panel did not agree that this would be a problem.
- Surface drainage over a frost bulb is a unique situation but techniques used on other engineering projects such as pipelines and highways provide experience according to Dr. Clark.
- Frost heave could raise the ground at berm breaks thus interfering with surface

Vol. XXIV
2727-2729

Vol. XXI
2478

Vol. XXII
2608-2615

Vol. XXVI
3153-3154

(b-5) Surface Drainage (Cont'd)TRANSCRIPT
REFERENCE

drainage. Dr. Clark pointed out that the thaw in summer would cause some settlement and part of the annual maintenance in the first 3 to 5 years would be to rectify drainage problems.

Vol. XXVI
3263-3267

- The erosive nature of surface and subsurface water and other factors was illustrated by Dr. McRoberts with slides of the slope failure at an inactive test section at the Sans Sault site. It was emphasized that no berms or ditch plugs or other commonly used techniques were employed. The major factors leading to failure were (1) the method of construction, (2) a two day soaking rain, (3) the slope gradient, (4) the finegrained soil and (5) the thin peat layer. Commission counsel pointed out that many of these conditions are not controllable and could occur along the pipeline.

Vol. XXVII
3319-3350

(b-6) Subsurface Drainage

- Sub-bed flow in rivers would be carried through the frost bulb by insulated culverts where this was essential in fish overwintering areas according to evidence led by Dr. Clark. In response to CARC cross-examination, sub-bed flow essential to fish overwintering would have to be significant and therefore in most cases wouldn't be frozen off by the frost bulb. Only small flows would be troublesome. Dr. Clark agreed that the use of an insulated culvert for this type of application is unique.

Vol. XX
2389-2394

- The use of culverts for sub-surface flow was also questioned by EPB in cross-examination. Dr. Clark pointed out that large subsurface flows are of most concern and such flow situations require a significant hydraulic gradient as is usually found on slopes. Since the pipeline generally crosses a slope along the 'fall line', the flow would be along and not across the frost bulb. It was pointed out that if the subsurface drainage culvert did freeze it would not thaw naturally and any flow would have to be brought to the surface and taken across the pipeline through berm breaks.

Vol. XXII
2597-2607
2625

- There are no specific reports to show that culverts through the frost bulb will be effective according to Dr. Clark in cross-examination. The culvert sizing and spacing will have to be made after determining the extent of winter and summer aquifers, fish overwintering and icings. These determinations will be made in advance of the pipeline construction and suitable culverts will be placed

Vol. XXVI
3152-3153

Vol. XXIII
2729-2735

Vol. XXI
2481-2497

(b-6) Subsurface Drainage (Cont'd)TRANSCRIPT
REFERENCE

- across the potential frost bulb area above the pipeline.
- The areas requiring a culvert through the frost bulb have not yet been identified on a site specific basis according to Dr. Clark in cross-examination by commission counsel. Seasonal variations in flow might cause problems and Dr. Clark conceded that the culvert solution as proposed requires a lot of attention. No testing has been done. Areas where subsurface flow conditions existed requiring the culvert solution were estimated to be less than one half of one percent of the route in the discontinuous permafrost zone.
 - The general design and installation of the culvert was described by Dr. Clark. Although the criteria for locating culverts is not yet established, one aspect will be the protection of fish overwintering areas. Dr. Clark disagreed with the contention that trenching across streams could drain fish overwintering areas.
 - The techniques to be used in crossing beaded streams so as to protect the fish are not yet clear according to panel cross-examination by commission counsel.
 - Frost bulb impeded subsurface flow on slopes could lead to formation of open system pingos according to commission counsel but this is not of major concern according to the panel.
- Vol. XXVI
3267-3271
- Vol. XXVIII
3459-3464
- Vol. XXI
2476-2481

(b-7) Vegetation-Erosion

- The erosion occurring after construction and before revegetation takes hold may just be a localized occurrence according to Dr. Clark in cross-examination by COPE. Dr. Hardy added that wind erosion has never been a significant problem on pipeline work.
 - The effect on permafrost of removing trees and vegetative mat cover from along the right-of-way was subject of cross-examination by commission counsel. The degree of permafrost degradation resulting from such activity was supported by a paper from the second annual permafrost conference. Dr. Slusarchuk agreed
- Vol. XXVII
3350-3360

(b-7) Vegetation-Erosion (Cont'd)TRANSCRIPT
REFERENCE

that revegetation would not prevent the degradation of permafrost but would simply slow it down. However, it was emphasized that the chilled pipeline would effectively halt degradation and would return the permafrost to at least its initial level. The problem would exist on cleared winter roads.

(b-8) Roads

- The environmental impact of removing water or snow from small lakes to make snow roads was of concern to the Environmental Protection Board (EPB) in cross-examination. The techniques of this construction using heavy equipment was pursued by COPE. Some small ice covered streams might be used as winter roads, particularly in the Delta. Vol. XXIII
2701-2704
- The settlement of the ground surface due to degradation of the permafrost along road right-of-ways could lead to ponding of surface water and interference with drainage according to the panel in cross-examination. No reports on this are available from the test site roads although revegetation observations are the subject of annual visits by biologists. Vol. XXIV
2803-2805
- The settlement of the ground surface due to degradation of the permafrost along road right-of-ways could lead to ponding of surface water and interference with drainage according to the panel in cross-examination. No reports on this are available from the test site roads although revegetation observations are the subject of annual visits by biologists. Vol. XXVIII
3361-3375

(b-9) River Crossings

- Gravel would not be removed from river beds to levels that would significantly affect the river although some extensive excavation could take place on bars in the active flood plain according to Dr. Cooper. Vol. XXIV
2799-2803
- The sediment carrying capacity of the Mackenzie is known but on other rivers only an idea of the degree of the capacity is known according to Dr. Hardy in response to COPE. Dr. Hollingshead indicated that the sediment effect on fish resulting from construction of the Bear River crossing had been considered by the environmentalists and was not significant. Vol. XXIV
2814-2815
- In crossing a small 10 to 30 foot wide single channel, the ditch spoil will be placed on the ice and then placed on top of the pipe according to Dr. Hollingshead. The construction Vol. XXIV
2809-2811
- In crossing a small 10 to 30 foot wide single channel, the ditch spoil will be placed on the ice and then placed on top of the pipe according to Dr. Hollingshead. The construction Vol. XXV
3042-3049

(b-9) River Crossings (Cont'd)TRANSCRIPT
REFERENCE

- and bank repair work would be done in the winter.
- Some environmental concerns would be removed by using overhead crossing but this would lead to other concerns according to Dr. Hardy. Vol. XXV
2975-2979
 - The archeological and recreational potential of the downstream part of the Swimming Point river crossing as identified by commission counsel was not known to the panel. Vol. XXV
3055-3056
 - River training works might be placed outside the pipeline right-of-way according to Dr. Hollingshead. The details of when and where these works will be built have not been identified making discussion of the possible environmental damage inconclusive. Vol. XXV
3019-3024
 - The volume of material to be excavated in the Point Separation dual river crossing was calculated by Drs. Clark and Hollingshead at the request of commission counsel. The impact of disposing of this 1.75 million cubic yards of material by placing it on the ice downstream from the trench, as indicated in the application, was questioned. The panel indicated that other disposal methods might be contemplated. Dr. Hardy hastened to add that this volume of material in a river the size of the Mackenzie would not be unique since similar volumes relative to river size are disposed of in rivers such as the Fraser. Vol. XXVI
3114-3129
3278-3279

(b-10) Pointed Mountain Pipeline

- A general description of the problems on the Pointed Mountain Pipeline was given to counsel for the Indian Brotherhood by Dr. Hardy. One river crossing was threatened by a shift in the river which cut a bank and exposed the pipe. Other parts of the pipeline floated up in the muskeg and in one location erosion was causing siltation in a lake. Dr. Hardy added that at one time there were 12 government inspectors on the 22 miles of the line. Vol. XXIII
2739-2745
2949
- The unique features of the river area at Pointed Mountain line contributing to the problems there were outlined by Dr. Hardy as (1) nature of the Vol. XXV
3000-3017

(b-10) Pointed Mountain Pipeline (Cont'd)TRANSCRIPT
REFERENCE

basin, (2) climatic factors, (3) vegetation characteristics, (4) river bed materials. It was emphasized that the 'failure' was an environmental one and would have occurred without the presence of the pipeline. Dr. Hardy disagreed that the repair of the river bank to protect the exposed pipeline was causing environmental damage. This damage was noted in a government report by Owen.

(b-11) Blasting

- Only the Mackenzie, Liard, and Bear Rivers are likely to have severe ice jams, which, in an emergency would be blasted according to the panel. Some ditch will have to be blasted but COPE was assured that if it endangered caribou, construction would be flexible enough to permit a delay until the caribou had left the area.

Vol. XXIV
2829-2835C. Socio-Economic

- In a statement read into the record and filed as an exhibit, Mr. J. Mercredi of Fort Simpson stressed the irrelevance of most of the government funded studies in the north to the people who live here. The inconsistency between the governments stated objectives in the north which put people first, and the nature of the studies being undertaken was illustrated by reference to a government publication listing northern study programs. Vol. XXI
2516-2526
- A letter from a nurse in Aklavik was read into the record. It pointed out the frustrations being experienced by the people of Aklavik faced with rapid development. Sixty percent of the total care in Aklavik is alcohol based and drug dependency, V.D., and other diseases are increasing. The catastrophic effect on families was noted. Vol. XXVI
3088-3090
- The Pointed Mountain Pipeline had no socio-economic guidelines to the knowledge of the panel. Dr. Hardy pointed out that there were no communities near the route. Vol. XXIII
2745-2746

D. MiscellaneousTRANSCRIPT
REFERENCE

- The minutes of two meetings in May of 1972 between the proponents of a Mackenzie Valley Pipeline and the Federal Government were filed as an exhibit by Arctic Gas in response to a request by CARC. Vol. XX
2405
- A letter from the Commissioner of the Northwest Territories was read into the record. It apologized for the misunderstanding caused by previous telex messages which were intended to advise Government employees of their position relative to the Inquiry. The Commissioner expressed his complete support for the Inquiry and withdrew the previous telexs hoping that his staff could meet with the Inquiry staff to rectify any misunderstandings. Vol. XXVI
3085-3087
- The Inquiry will hear arguments from the various participants on the timing of hearing evidence relative to pipeline corridors. This has now been scheduled for April 18. Vol. XXIX
3561
- COPE indicated it might have to request an adjournment of the hearings so that it can prepare itself in the light of documents recently released by Arctic Gas. It was pointed out that some of these reports were over a year old and it was therefore a violation of the preliminary rulings for Arctic Gas not to have previously listed these as being in their possession. Arctic Gas apologized and suggested that, if prejudiced, participants could reopen cross-examination. Vol. XXIV
2764-2768
- Commission counsel received a letter from CARC, the N.W.T. Indian Brotherhood, the N.W.T. Métis Association, the Council for Yukon Indians and COPE/ITC requesting that the Minister of Indian and Northern Affairs be asked to appear before the Inquiry to answer questions on government policy and procedures. This letter was not read into the record but was released to the press.

E. Inquiry Schedule

- The panel on System Configuration and Design of Facilities will sit from April 14th to 19th and will consist of the following people:
- H. Purcell, G.G. King, C.M. Koskimaki, C.M. Reig, P. Price,
J.J. McMullen, D.E. Rathje, and M.E. Holberg.

The panel on Construction will sit from April 21 to April 23 and will resume, pursuant to adjournment, on May 12.

Community hearings in Hay River are planned for the latter part of May.

The Environment Protection Board is expected to present evidence in early June.

Several community hearings are expected to take place in the lower Mackenzie area in late June and July.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT NO. 73)

ARCTIC GAS - GEOTECHNICALYELLOWKNIFE, N.W.T.
OCTOBER 16, 1975

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TOPIC: Phase I: Engineering and Construction of the Proposed Pipeline.

Geotechnical Rebuttal Evidence by Arctic Gas
(in chief only)

DATE: October 16, 1975 in Yellowknife.

WITNESSES: Arctic Gas' panel consisting of:

Dr. J.I. Clark:	Supervisor, Geotechnical and Environmental Studies, Northern Engineering Services Co. Ltd. (NES)
Dr. W.A. Slusarchuk:	Manager, Geotechnical and Geothermal Studies, NES.
Dr. N.R. Morgenstern:	Professor, University of Alberta and Consultant to NES.
Dr. P. Hoekstra:	Senior Geophysicist, NES.
Dr. R.M. Harlan:	Senior Engineer, R.M. Hardy and Associates.

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 General Comments on Dr. Williams' Evidence

- | | |
|--|------------------------|
| - If Dr. Williams evidence is correct, the pipeline cannot be built, according to Dr. Clark. | Vol. 73
10824-10833 |
| Dr. Williams' views are unique and do not reflect those widely held by experts in the field. His theory if correct, would hold equally in the continuous and discontinuous permafrost zone making a viable chilled pipeline impossible to build. It is not better to deal with thaw settlement problems rather than those associated with frost heave. Both are equally bad. The concept of modifying the gas temperature by regulating the cooler isn't mechanically feasible or physically desirable because the pipe would start to float as the ground melted. | |
| - The theory expressed by Dr. Williams is not in keeping with this project and none of the data supports his view while it does support the view of NES, according to Dr. Clark. NES never said it would stop heave completely. They did assert that it could be controlled within known limits. The action behind the freezing front (in the frost bulb) described by Dr. Williams is of little engineering significance. Both Dr. Clark and Dr. Morgenstern asserted that the pipeline can be built as it is now conceived. | Vol. 73
10944-10947 |
| - NES is well aware of the established theory referred to by Dr. Williams, and they do not accept the view that their approach is narrow, according to Dr. Morgenstern. The empirical approach is often the only way to develop engineering solutions when dealing with natural materials. There is no need to apologize for that. It simply recognizes the limits of theory. The 18 months of testing supports and confirms NES's basic hypothesis that the heave rate can be controlled by the application of pressure. | Vol. 73
10940-10944 |

TRANSCRIPT
REFERENCE

- The work is not 'pioneering' since one can trace the basic theory back to the 1930's, according to Dr. Slusarchuk in response to the Judge's questions. The theory has never been applied before because a situation, such as a chilled gas pipeline, did not present itself. Vol. 73
10931-10934
- If Dr. Williams' theory is correct, a buried chilled pipeline is not feasible and consideration would have to be given to elevating parts of the line, according to Dr. Clark in reply to the Judge's questions. An elevated pipeline would present metallurgical, cost and environmental impact problems. Dr. Clark was not aware that the company policy would be if they were forced to go to an elevated pipeline. Vol. 73
10971-10921

a-2 Shut-Off Pressure

- The shut-off pressure described by Dr. Williams as the maximum heaving pressure that exists when a soil freezes with no volume change, contradicts the NES shut-off pressure concept, according to Dr. Slusarchuk. Using graphs to explain his point, Dr. Slusarchuk showed that the NES shut-off pressure occurs where the load (pressure) is sufficient to stop water from flowing into the freezing soil from the unfrozen soil. The pressures described by Dr. Williams are beyond this value-being those loads required to achieve a no-heave, no-volume change condition. These are not applicable to a pipeline that can stand some heave. NES's object is to try to control water moving into the freezing front. If one allows the soils to heave just slightly, the associated high pressure drops off immediately. NES conducts constant load tests rather than constant volume tests since this is what will be happening in the field in a buried chilled gas pipeline. By application of the shut-off pressure using deep burial or a surcharge berm, one can stop water movement into the freezing front. Then the redistribution of moisture behind the frost front is not critical. NES assumes the most conservative case by calculating that all water behind the frost front freezes inside. Vol. 73
10833-10856

a-3 Hydraulic Conductivity

- Once one moves away from the 0°C isotherm into the frozen soil, there is a very drastic decrease in hydraulic conductivity, according to Dr. Harlan. Before NES began their work there were very few quantitative hydraulic conductivity measurements in frozen soil. The ice lenses behind the freezing front don't increase in size while at the freezing front the lens do grow. This tends to form an impermeable barrier blocking the flow of water to the inside frozen zone. Very long term heave would occur but this is of no engineering significance. The process is controlled by the rate of moisture migration. Vol. 73
10872-10893

a-4 Experimental Work

- The reference by Dr. Williams to laboratory work by Hoekstra to support his argument of the high forces required to stop heave, was discussed by Dr. Hoekstra. Dr. Hoekstra explained that those pressures originated from constant volume tests where no heave was allowed. This is not applicable to a pipeline where some heave is permitted. While the pulling forces within the frozen bulb may be high because of the low temperature, the forces get progressively less moving toward the frost front because the temperature approaches 0°C. Therefore, the load required to stop the immigration of water is that calculated from 0°C, not the high loads resulting from consideration of lower internal temperatures. The Vol. 73
10857-10872

TRANSCRIPT
REFERENCE

- temperature determines the force. Dr. Hoekstra said he therefore disagreed with Dr. Williams. Dr. Slusarchuk added that there is no point in stopping the redistribution of water within the frozen soil because the heave so produced is not sufficient from an engineering viewpoint.
- NES rejects Dr. Williams' contention that they have ignored a considerable body of existing knowledge in arriving at their experimental results. NES is fully aware of the state of the art even beyond what Dr. Williams cites, according to Dr. Slusarchuk. NES has discussed their work with a broad range of experts including Penner at NRC who suggested NES approach is reasonable. Vol. 73
10893-10899
 - Recent results of the ongoing work at the Calgary test site were described by Dr. Slusarchuk. The results show that over a long period the methods established by NES are overpredicting the actual heave. This is based on 1½ years of experimental evidence and confirms that the methods are acceptable for pipeline engineering purposes. Contrary to what Dr. Williams suggests, it shows that as the frost bulb gets larger the shut-off pressure gets smaller. The field tests shows that after 18 months there is no heave behind the frost front which is consistent with NES's views and not a paradox as Dr. Williams suggests. Vol. 73
10899-10917
 - The criticisms of Dr. Williams with respect to the accuracy of measuring the heave in laboratory samples is of absolutely no pipeline engineering significance, according to Dr. Slusarchuk. Vol. 73
10921-10931

a-5 Differential Heave

- Dr. Williams' views on differential heave assume that the pipe is not able to take some strain and some movement, according to Dr. Slusarchuk. This is not the case. The pipe can take a significant differential heave. The understanding of this requires a pipe-soil interaction analysis such as that being done by NES. Vol. 73
10934-10938

a-6 Slopes

- The Foothills panel's criticism of NES's use of the coefficient of consolidation (C_v) theory in slope stability analysis was addressed by Dr. Morgenstern. He explained the basis for the theory and its application pointing out that without the theory there would be no sound basis to make assessments under changing field conditions. Foothills contention that Arctic Gas is bogged down in paper work is simply not true. All slopes along the route have been inspected by at least 2 geotechnical specialists. Twenty-three sites covering the entire range of worst case conditions have been selected and investigated in detail. Vol. 73
10947-10965

a-7 Rivers

- NES does not disagree with the evidence by Dr. Lewis (on rivers) and is in fact working along the same lines as he had suggested, according to Dr. Harlan. This is in particular reference to Dr. Lewis's three recommendations: (1) the culvert concept be incorporated into the Batelle model, (2) a field drilling program be initiated to determine valid input data for the model and, (3) the culvert concept be tested.

TRANSCRIPT
REFERENCEB. Environmental

nil

C. Socio-Economic

nil

D. Miscellaneous

- The cross-examination of Dr. Adam of the Environmental Protection Board was interrupted to hear the above rebuttal.

Vol. 73
10813-10820

Policy and Planning (ACND)
Division.
October 28, 1975.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. XXIX TO XXXII)

ARCTIC GAS
SYSTEM CONFIGURATION AND DESIGN OF FACILITIES

YELLOWKNIFE, N.W.T.

APRIL 14-18, 1975

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TOPIC: Phase 1; Engineering and Construction of Proposed Pipeline.

Panel on: System Configuration and Design of Facilities

DATE: April 14th to 18th in Yellowknife

WITNESSES: Panel on System Configuration and Design of Facilities.

- Mr. H. Purcell: Project Co-ordinator, Mechanical and Systems Design, Northern Engineering Services (NES)
- Mr. G.G. King: Manager, Systems Design Group, NES
- Mr. C.M. Koskimaki: Supervisor of Mechanical, Electrical and Compressor Station Local Control Design, NES.
- Mr. C.M. Reid: Supervisor of Pipeline Mechanical Design, NES.
- Dr. P. St. J. Price: Supervisor of Mechanical Stress Analysis, NES.
- Mr. M.E. Holmberg: President, Metallurgical Consultants Inc.
- Mr. J.T. McMullen: Senior Communications Design Engineer, NES.
- Mr. K.E. Rathje: Corrosion Engineer, NES.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 General

- The Design Group under Mr. Purcell was responsible for the following parts of the application section 8; Location Design and Capacity of Facilities: Vol. XXIX 3645-3650
 - 8(b)1.1 Summary of Projected Gas Volumes by Year and Expansion for Throughput Increases
 - 1.2 System Configuration
 - 1.4.1 Codes, Standards and Regulations
 - 1.4.2 Pipeline
 - 1.4.3 Compressor and Gas Measurement Stations
 - 1.4.7 Corrosion Control
 - 8(b)2 Formulae and Basic Assumptions
 - 8(b)3 Facilities and Design Capacity
 - 8(b)4 Flow Diagrams
 - 8(b)5 System Capability and Analysis
 - 8(b)6 Material Specifications
 - 8(b)7 Communications and Supervisory Controls.
- The three main objectives of the group, according to evidence led by Mr. Purcell, were: (1) to achieve technically correct designs, (2) to utilize present day technology and (3) to achieve an optimum design to transport gas at a minimum cost. The work done to date is in sufficient detail to support an application before regulatory bodies. Further detailed work was not done because of cost and the possibility of changes imposed by the regulatory agencies. Vol. XXIX 3651-3654
- The design utilizes existing and tested technology to arrive at solutions to the main areas of concern which, according to Mr. Purcell, were (1) System Design, (2) Pipeline Design, (3) Metallurgy, (4) Stress Analysis, (5) Station Design, (6) Corrosion, (7) Communications. Vol. XXIX 3655-3657 3755-3761

A. Technical/Engineering (Con't)TRANSCRIPT
REFERENCE

- The design responsibilities of NES included the Alaskan portion of the pipeline but excluded areas south of the 49th parallel according to Mr. Purcell in cross-examination by Foothills. The cross-examination by Foothills and Commission Counsel pointed out that the following design aspects were outside the responsibilities of the design group: (1) pipeline location, (given by Williams in 1973), (2) points of gas supply and delivery (given by CAGPL 1972), (3) gas composition (influenced by Purcell), (4) design gas volumes for each operating year (given by CAGPL in 1973) and (5) Pipeline Size (given by CAGPL using background information supplied by NES). The design as filed was accepted by CAGPL without significant change. Vol. XXX
3769-3776
- Mr. Horte will answer questions on how the design factors given to NES were determined. Vol. XXX
3866-3869

a-2 Natural Gas

- The ability of the gas fields to produce gas was a subject not known to the panel according to Foothills cross-examination. Similarly the market destination of the gas was beyond the field of expertise of the panel. Vol. XXX
3787-3788
- The difference between solution gas and cap gas was described by Mr. Purcell for COPE. It was suggested by COPE that since Prudhoe Bay gas was solution gas it would need to be reinjected initially to facilitate oil extraction. Hence, the Delta cap gas would have to meet all the early pipeline requirements. This would only be true for the first operating year according to the panel. A detailed explanation could be provided by Mr. Horte later in the hearings. Vol. XXXII
4052-4056
- The quality of the Prudhoe Bay and Delta gas in the pipeline will be a function of the reservoir and the gas processing plants but neither gas is sour according to the panel in cross-examination by Foothills. Prudhoe Bay gas is of higher heating value (rich) than the Delta Gas (lean). The difference in heating value (about 10%) between the two gases will be measured at each source, the Alaska-Yukon border and at each delivery point to allow compensation for the effect of mixing the gases at Travaillant Lake. Vol. XXX
3789-3793
- If both the 42-inch lines going south to the United States are operated at capacity, all the gas from the Delta would go to U.S. customers according to Foothills. Justice Berger ruled this topic beyond the scope of this Inquiry and the subject was abandoned. Vol. XXXI
3875-3882
- The higher proportion of liquids in the Prudhoe Bay gas would lead to liquid spills if the Alaskan feeder line ruptured, according to Foothills. The panel disagreed, pointing out that the ambient temperature, the rate of decompression and evaporation would limit the volume of liquid to insignificant amounts. Vol. XXX
3793-3898

a-3 Buried vs. Elevated Gas PipelineTRANSCRIPT
REFERENCE

- The reasons for selecting the buried rather than the elevated pipeline mode as outlined by Mr. Purcell were: (1) familiarity with the buried pipeline mode, (2) security, (3) less barrier to animals, (4) aesthetics, (5) need to insulate an elevated line, (6) otherwise the energy carrying capacity of the line would be reduced since the gas would have to be primarily methane, (7) the need to chill either line - above ground insulated or buried, (8) special pipe metallurgical requirements of an elevated line (9) higher methanol requirements for testing an elevated line, (10) earthquake susceptibility of an elevated line. Mr. Purcell indicated that the cost of constructing an elevated line would be 60% more than a buried line. Vol. XXX 3761-3768 Vol. XXXI 3992-3994
- If an above-ground portion of the pipeline was accidentally ruptured, Mr. Purcell indicated that the gas would escape under terrific pressure, the pipe might be subject to a whipping action, and a fire might be ignited by the static electricity produced by condensing gas. In frozen ground, the pipe would be very stable and it was reported that suggestions had been advanced theorizing that the frozen ground could carry the gas without the pipe. Vol. XXXII 4059-4064

a-4 Pipeline Design

- The Arctic environment and the large scale (pressure and pipeline size) of the project were special design considerations. Chilling was required to keep the gas within practical temperature limits and the degree of cooling was dictated by the existence of permafrost, according to Mr. Purcell. Vol. XXIX 3665-3670
- This pipeline can justify the scale of the design because of: (1) the availability of bigger and heavier pipe and (2) the volumes of gas required by the potential markets, according to Mr. Purcell in response to the Judge's questions. Vol. XXX 3869-3970
- The 'present day technology' claim of the panel was disputed by Foothills since the combination of a 48-inch, 0.720 wall, 1680 psig pipeline is unique. Vol. XXX 3800-3805
- The 'minimum unit cost' claim of the panel was disputed by Foothills. They contended that the pipeline sizes were not justified by the gas volumes north of Travaillant Lake and south of Caroline, despite the fact that CAGPL, not NES, decided both the size and volume figures. Vol. XXX 3779-3785
- The decision on the size of the pipeline was made by CAGPL by reference to NES studies of total costs and gas carrying capacities of different sized pipelines, according to Mr. Purcell in re-examination. Vol. XXXII 4019-4030
- The two 48-inch feeder lines to Travaillant Lake are capable of carrying a total of 4.5 billion cubic feet per day. If operated at this volume, the 48-inch line south from Travaillant Lake would have to be looped according to Foothills cross-examination. There have been no studies on looping although some information is available from a preliminary looping analysis done when a 42-inch line was being investigated. Vol. XXX 3785-3787

a-4 Pipeline Design (Con't)TRANSCRIPT
REFERENCE

- Forty-two inch supply lines to Travaillant Lake could carry the projected volumes of gas at a lower unit cost because of lower capital and construction costs, according to Foothills' cross-examination. The 48-inch lines would delay the need for looping. No decision has been made on the 42-inch alternative as proposed. Vol. XXX
3776-3778
3862-3866
- Arctic Gas has not instructed NES to study looping, according to the panel in cross-examination by COPE, even though the two feeder lines are capable of delivering twice the quantity that can be handled in the single line south of Travaillant Lake. This would indicate the need to loop the main line before the supply lines since additional compression on this line would not yield substantial increases in throughput. The 48-inch line south from Travaillant Lake would be operating at full capacity at the 5 year volumes proposed in the application. Justice Berger asked that this be explained by Mr. Horte when he appears since it might have an effect on the width of the right of way, renewal of construction activity, life of the pipeline etc. Vol. XXXII
4019-4030
Vol. XXXII
4073-4075-A
- A design review will be done as more detailed information becomes available, according to Mr. Purcell in cross-examination by CARC. Since a one year lead time would be required for pipe supply, CARC questioned how a design review change could be incorporated into the system. Mr. Purcell indicated that in such instances the specifications could not be changed but changes could be made in operating procedures. Vol. XXXI
3884-3886

a-5 Pipe Fabrication

- The steel specifications were developed by a metallurgical sub-committee of representatives from the various Arctic Gas sponsoring companies, according to Mr. Purcell. Vol. XXX
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- The 1973 sub-committee report ranking the various pipe manufacturers' ability to produce the required quantity and quality of pipe, was quoted by Foothills in cross-examination. There were 4 Japanese mills, one German, one Italian and one Canadian mill capable of producing the pipe in 1973. Stelco, the Canadian mill, had no demonstrated capability according to the 1973 report. The test sections of pipe provided to Arctic Gas did not always meet the specifications. Mr. Holmberg indicated that these were samples only and the mills had no advantage of long production run experience. It was pointed out by Foothills that Stelco had to reject many samples before one was turned over to be tested. Vol. XXX
3814-3838
- Making the required quality steel and then rolling it into pipe are the two main problems to be overcome according to Mr. Holmberg. The steel plates are 40 feet by 12.5 feet by 0.720 inches thick and require considerable skill to make without flaws. The plate is cold rolled to form a pipe. Mr. Holmberg disagreed with Foothills' suggestion that this was a new technology. He suggested it was simply advancing existing technology. Vol. XXX
3856-3862

a-5 Pipe Fabrication (Con't)TRANSCRIPT
REFERENCE

- The pipe would be ordered from several suppliers to assure supply, according to Mr. Holmberg in cross-examination by COPE. The quality of pipe would not vary significantly because of rigid testing and inspection at each mill. The manufacturers inspect the steel plate and hydrostatically test each section of pipe. Inspectors from Arctic Gas check all tests and do independent tests at each mill.

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4047-4052

a-6 Pipe Stresses

- The stress on the pipe under various loading conditions was described by Dr. Price. Wrinkling and buckling of the pipe wall was studied in 48-inch pipe at the University of California for the Trans-Alaskan pipeline. This pipe had a lower yield stress and thinner wall thickness than the CAGPL pipe. The bending stress and strains determined the permissible radius of curvature of the pipe which could be caused by buoyancy, differential frost heave, settlement, unbalanced lateral forces at field bends or earthquakes.

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- The allowable pipe movement at bends would have to be restricted and, because of the natural rigidity of the 48-inch pipe, there will have to be a large number of field bends to make the pipe fit the ditch contours. Continuing with their cross-examination, CARC was told that after the ditch is opened, the maximum pipe curvature would be 1.5 per pipe diameter. A 90° bend would require 400 feet of pipe and a certain lead distance to avoid an obstruction such as an archaeological site. It was affirmed that pipe bends are no more sensitive to failure than a straight run of pipe. If the pipe wrinkled in a field bend it would be discarded.

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3889-3894

- Fatigue loading failure was described for CARC by Mr. Holmberg. A loading of millions of cycles would be required and generally fatigue failures are not a problem on pipelines.

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- The bends in the pipe at the test facilities were prefabricated according to cross-examination by CARC. Other points raised by CARC were (1) the decision to use thicker wall pipe at river crossings is a design decision, (2) the deflection of the pipe at the University of California test was 20 times greater than the allowable limit specified for this pipeline.

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- The design group specified the permissible radius of curvature for the geotechnical group according to Mr. Purcell. Dr. Price agreed that the curvature along the pipe could vary due to the inconsistent nature of the frost bulb around the pipe. The bulb could crack and concentrate stresses on the pipe but these concentrations would be minor according to Dr. Price.

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3897-3900

- The pipe at river crossings would be thicker, according to cross-examination by CARC, because of the pipes: (1) greater resistance to buoyancy, (2) ability to withstand the greater stresses during construction, (3) strength under the variable forces at river crossings and (4) because it is convention practice. There are no special river crossing monitoring features presently being contemplated.

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a-6 Pipe Stresses (Con't)TRANSCRIPT
REFERENCE

- The pipe on the Alaskan portion of the line would be 0.8-inch wall while the Canadian portion would be 0.72-inch wall because of differences in the codes of the two countries according to Mr. Purcell in response to CARC's cross-examination Dr. Holmberg in response to questions by the Judge, gave the history of how these code differences occurred pointing out that U.S. authorities are reviewing their code in light of Canadian experience in basing design on test pressures. It was pointed out that in addition to the above national differences in pipe wall thickness, river crossings would be 1.034-inch wall and the pipe at compressor stations would be 1.25-inch wall.

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a-7 Pipe Crack Propagation

- The details of crack initiation and propagation was described in chief by Mr. Purcell and Mr. Holmberg. At lower temperatures the danger of a brittle fracture increases. A brittle fracture propagates at 1,500 to 3,000 feet per second as opposed to a ductile failure which propagates at 400-700 feet per second. Since the brittle fracture propagates faster than the rate at which the pipe can decompress, the crack continues to be subject to the internal pressure of the pipe. To avoid crack initiation all defects in the pipe must be detected at the mill and after construction. The pipe steel specified is such that it will fail in a ductile manner at ambient conditions, but tests on 48-inch pipe at simulated operating conditions showed that failure predictions cannot be made by the Battell hypothesis. Therefore, reinforcing bands or 'crack arrestors' are to be used on the pipeline.
- The fracture arrestment tests and techniques were questioned by Foothills in cross-examination. The arrestors were described by Mr. Holmberg as a 4 foot piece of 48-inch pipe split and placed on the main pipe. They would be held on the pipe by friction at about 300 foot intervals. The tests on the crack arrestors was conducted by Battell in Ohio on 48-inch pipe. A crack was initiated by cutting a notch in the test pipe and detonating an explosive to overstress the pipe. Three of the five tests were used to test the arrestors. Mr. Holmberg indicated that the use of crack arrestors was very, very conservative in design, and although the idea was new for pipelines, it is common in the shipping and aircraft industries. He agreed that the danger of cracking could be reduced by reducing the pipeline pressure and diameter.
- The decision to place the crack arresting bands at 300 foot intervals is based on the length of pipe that could be repaired in a short time, according to Mr. Purcell in cross-examination by COPE. The weight of the 35,200 bands required over the length of the pipeline would have no significant frost heave surcharge effect. The arrestors would be shop installed at the ends of the pipe and therefore would not affect the field bending of the pipe.

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a-7 Pipe Crack Propagation (Con't)

TRANSCRIPT

REFERENCE

- The arrestor band halts crack propagation by:
 - (1) reducing the pressure at the crack tip and
 - (2) restraining the opening of the pipe, according to cross-examination by Commission Counsel. All the tests were on 800 foot sections buried pipe and three were conducted in ground frozen about a foot around the pipe. The last test was subject to some whipping action causing crack reinitiation beyond the crack arrestor. The frost bulb around the pipe would be beneficial in restricting pipe fracture according to re-examination of Mr. Holmberg by Arctic Gas.

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4087-4096Vol. XXXII
4165-4168a-8 Welding

- Seam weld quality will be controlled in the pipe mills and the girth weld will be done in the field according to evidence led by Mr. Purcell. Automatic and manual technique are being investigated for low temperature environments and welds are now being evaluated. Mr. Holmberg described the automatic welding machines.
- The welding procedures were established by the metallurgical sub-committee and Mr. Holmberg wrote the specifications, according to Mr. Purcell in cross-examination by Foothills. A 0.720-inch wall pipe requires more welding passes than a thinner wall pipe and, according to Mr. Holmberg, this decreases the risk of weld failure.
- The final decision on the extent of automatic welding to be used on the pipeline will be made within 6 months. The Judge expressed interest in this since it would affect the number of trained welders and perhaps northerners who would be employed on the pipeline. It was pointed out that the manpower requirements would not be decreased by utilizing automatic welding machines.
- Alaskan tests have proven the viability of automatic welding and they presently have equipment for two spreads on order according to Mr. Holmberg in cross-examination by Commission Counsel. CAGPL is now having welding tests done by commercial labs. Present uncertainties are related to the equipments cold weather capabilities and the effect of heat input on hardness at the outer edge of the weld. One of the reasons automatic welding is being investigated is because of the probable shortage of trained welders for the CAGPL line. The total manpower is not reduced in utilizing automatic welders - but unskilled labour can be quickly trained to operate the automatic machinery.

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4150-4157a-9 Corrosion

- Several corrosion prevention coatings are feasible in permafrost as is cathodic protection according to Mr. Purcell. Laboratory tests and a literature search have shown the effectiveness of coatings at low temperatures, the effect of temperature on soil resistivity and the effect of anode backfill and temperatures on ground bed design. Internal corrosion would be controlled by a 2 mil. interior coating and by controlling the accumulation of liquids in the pipeline.

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a-9 Corrosion (Con't)

TRANSCRIPT
REFERENCE
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3909-3911

- There were no corrosion field tests at the test sites in the north according to Mr. Rathje in cross-examination by CARC. At low temperatures corrosion is expected to be less than at higher temperatures. The interior coatings would be either a polyamide catalyzed coating or an amine adduct catalyzed epoxy resin both of which have been used elsewhere on pipelines. These would not be soluble in the methanol test fluid. The above ground external coating that failed at the Sans Sault test site would not be used.
- Atmospheric corrosion on the north slope pipeline stockpiles would be more severe than elsewhere, according to cross-examination by COPE. The external coatings contemplated are (1) polyethylene tape and (2) epoxy coating applied at the mill. Vol. XXXII
4056-4059
- The cathodic protection is limited by the soil conditions and, according to Mr. Rathje, it may have to be varied where the pipe is in thawed soil prior to start up. The final details on factory or on-site coatings have not yet been finalized but in any event, inspection of the installed pipe will be made to repair any damages to the coating due to handling. An unprotected portion of the pipe several inches in diameter could be protected by cathodic means if it was missed in inspection. Vol. XXXII
4096-4102
- A small leak caused by corrosion would not lead to rupture of the pipe according to Mr. Holmberg in cross-examination by Commission Counsel. If not repaired, the leak could erode the pipe over a long period of time. Vol. XXXII
4109-4111

a-10 Pipeline Testing

- A general description of the two hydrostatic test methods to be used was given by Mr. Reid. After installation, the pipe will be subjected to a test to 125% of the operating pressure using either warm water or a water-methanol (freeze depressant) solution. The warm water test requires large volumes of water (up to 2½ times the fill volume) and could thaw the permafrost around the pipe. Generally, it will be used in 5 to 10 mile test sections in non-permafrost areas. The methanol test to be used in permafrost areas, reuses the same solution on subsequent 3 mile test sections and disposes of the solution at the end of the construction season by distillation and burning or by dilution and discharge to the environment. Water would be removed from the pipe after testing by a "pig" propelled by high pressure gas or compressed air. Vol. XXIX
3670-3680
- The warm water test was described in more detail during cross-examination by CARC and Commission Counsel. All tests will be done in the winter using water heated and circulated through the test section until the pipe was above freezing. The test section would then be sealed and pressure tested. The water would remain in the pipe for up to 30 hours and when discharged would be temperature monitored but not monitored for quality. Although the warm water test method is commonly used in winter pipeline construction Vol. XXXI
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a-10 Pipeline Testing (Con't)TRANSCRIPT
REFERENCE

- it would generally not be used north of 60° latitude and only in places where there was an abundant water supply and the soil temperature was greater than 32° F. However, it might be used at river crossings in the Northwest Territories where permafrost is not a problem.
- The methanol test medium would be a 25% methanol solution according to Mr. Reid in cross-examination by CARC. This would require about 500,000 gallons of methanol per construction spread with each test solution reusable up to 47 times. Mr. Reid estimated the total methanol requirements at about 25 to 30 thousand tons or 6.25 to 7.5 million gallons. Vol. XXXI 3971-3972 3980-3987
 - The distillation of the spent methanol test medium would, according to Mr. Reid in cross-examination, yield a distillate solution of 70% methanol and a residue solution of 1% methanol representing 40% and 60% of the test medium volume respectively. The distillate would then be burned off and the residue diluted and discharged. Vol. XXXII 4126-4131
 - The seven breaks in the 26-inch and 34-inch Interprovincial pipeline, cited by CARC in cross-examination, probably occurred because the line was not hydrostatically tested according to Mr. Reid. Pipe inspection during manufacture and sophisticated 'electronic pig' techniques are not sufficient to detect all defects according to Mr. Holmberg. Vol. XXXI 3953-3961

a-11 Compressor Station Design

- The initial design task in locating the compressor stations, according to panel in cross-examinations, was to locate the hydraulically optimum points based on pipe size, station size and the design gas volumes. These locations were then changed slightly by the geotechnical group to account for terrain and subsequently rechecked hydraulically. The station locations are interdependant making it necessary to deal with individual station location flexibility on a site specific basis. The panel agreed to provide this information if a specific request was made. Vol. XXXI 3889-3911
- The main line compressor stations (south of Travaillant Lake) are designed for the 5th operating year volume of gas according to Mr. Purcell. Additional facilities (compressors and chilling equipment) for looping could be built within the same sites but a new station would be required if two pipelines were built. The stations for the 42-inch alternative on the feeder lines were kept at the same location as the 48-inch stations since it does not seriously affect the pipeline economics. Station spacing is dependant on: (1) flowing temperature of the gas which influences the horsepower requirement per mile, (2) optimum volume throughput for the size of pipeline, (3) cost of the fuel gas (gas to power the compressors etc.) which increases with distance down the pipeline. Vol. XXXII 4030-4035
- A general description of the compressor stations was given by Mr. Purcell and Mr. Koskimaki. The 15 stations north of Fort Simpson will each have a 30,000 h.p. turbine for compression and a 17,000 Vol. XXX 3729-3735

a-11 Compressor Station Design (Con't)TRANSCRIPT
REFERENCE

h.p. turbine for the closed loop propane refrigeration system. At Travaillant Lake a double refrigeration unit would be required. The first two stations south of Fort Simpson would be similar but without the chilling facilities. The second two stations require more compressor horsepower because of higher flowing gas temperatures and would require two 27,000 h.p. turbines. Stations further south would be similar to the last two described except they would have air cooled heat exchangers. The stations were sized on the basis of compressor units commercially available and the lowest total operating cost.

- The turbines would be of two types, industrial and aircraft derivative which require offsite overhaul every 12 and 3.5 years respectively, according to cross-examination by Commission Counsel. Vol. XXXII
4111-4113
- The decision to chill the gas was based on geotechnical considerations according to Mr. Purcell in cross-examination by Commission Counsel. There is a 5% advantage in chilling the gas when considering compressor station costs which in turn represent 30% of the project costs. There would also be cost considerations in the pipe and frost heave protection measures in a chilled/non-chilled analysis. Vol. XXXII
4102-4103
- Using the natural gas as fuel for the compressors and ancillary facilities will use 6 or 7% of the throughput according to Mr. Purcell in cross-examination by Commission Counsel. Other sources of power considered and rejected included hydroelectric power from a Bear River development and liquids from the Richards Islands gas. The cost of alternate power is the prime consideration. The power source decision would have to be made before design although it could conceivably change during the life of the pipeline if the value of gas increased. Vol. XXXII
4035-4039
- The gravel pad at the stations is larger than required for the compressor-chilling facilities to accommodate the initial construction camps according to cross-examination by COPE. The revised camp areas are smaller and this may lead to a reduction in pad size and hence gravel borrow requirements. The entire station site would be fenced in compliance with the code. On site above ground piping would total about 500 feet of 1.25-inch wall pipe which would not be subject to failure if struck by a rifle bullet. The stations would be unmanned. Vol. XXXII
4113-4115
- The gravel pad at the stations is larger than required for the compressor-chilling facilities to accommodate the initial construction camps according to cross-examination by COPE. The revised camp areas are smaller and this may lead to a reduction in pad size and hence gravel borrow requirements. The entire station site would be fenced in compliance with the code. On site above ground piping would total about 500 feet of 1.25-inch wall pipe which would not be subject to failure if struck by a rifle bullet. The stations would be unmanned. Vol. XXXII
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a-12 Communications

- The three communications alternatives for the pipeline according to Mr. McMullen, are (1) a leased microwave system, (2) a private microwave system, (3) leased channels on a satellite from TelesatCanada. The microwave system is proposed in the application but it is being reviewed in light of the Telesat proposal. If a microwave system was used 66 channels would be required to Fort Simpson, 42 to Inuvik and 30 to Vol. XXX
3741-3743
3746-3755

a-12 Communications (Con't)TRANSCRIPT
REFERENCE

- Prudhoe Bay. A satellite system would use the transponder presently reserved for the pipeline on Anik 1. Anik 2 would monitor Anik 1 and provide a switchover capability if required. Anik 3 would provide backup to Anik 2. Portable earthstations would be used during the construction phase.
- If the system was owned by CAGPL, the excess channels would be available for common use according to Mr. McMullen in cross-examination by the N.W.T. Indian Brotherhood and COPE. If other customers such as a railway or an oil pipeline were using the system a common carrier would have to be involved. During construction communication would be primarily via the public network system which, at peak, would load the system similar to the operation phase of the pipeline. The Brotherhood suggested seven pay phones per 800 man camp would be insufficient. They also asked if the microwave tower at Bear Rock could be relocated. Mr. McMullen said that it could.
 - There would be 100 microwave towers in Canada with over 50 in the Northwest and Yukon Territories according to cross-examination by Commission Counsel. If one tower failed it would take up to 5 days to erect a temporary structure and communications would be lost until alternate circuits could be arranged over the public system. It was pointed out in the cross-examination that a failure would probably occur after a major storm when the public system itself would be under stress. If an earth station goes out on the Anik system, the other stations would not be affected. Mr. Horte will testify later as to when the final decision on microwave or Anik will be made.

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4146-4150B. Environmentalb-1 Pipeline Testing

- The 25,000 to 30,000 tons of methanol (6.25 to 7.5 million gallons) required as a freeze depressant in testing the northern portions of the pipeline will be stored in diked bladder tanks before being diluted to a 25% solution for testing, according to Mr. Reid in cross-examination by CARC. To make up the test solution 18.75 to 22.5 million gallons of water would be required yielding 25 to 30 million gallons of test fluid which, in turn would require 625 to 750 million gallons of water to dilute to a 1% solution if dilution was used exclusively as a disposal technique. If a failure occurred during a test the spilled test solution would be recovered by suction pumps. Commission Counsel pointed out that the solution that penetrated into the frozen ground would not be recoverable.

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4123-4124

b-1 Pipeline Testing (Con't)TRANSCRIPT
REFERENCE

- The environmental effect of the warm water testing technique was explored by Commission Counsel in cross-examination. The millions of gallons of warm water would be discharged onto the ice to cool. This would be used at major river crossings such as the Mackenzie. The decision on where to use this type of test will be part of the final design and will depend on: (1) environmental sensitivity, (2) the availability of sufficient quantities of water and, (3) the existence and type of permafrost. Environmental advisors will be consulted. The statement by Mr. Reid that the fish biologist would have a veto on the test and disposal method was modified in re-examination to state that the final review process was not yet finalized by the applicant. Vol. XXXII 4120-4123
- The two methods for disposal of the water-methanol test solution were described by Mr. Reid as, (1) dilution or (2) distillation. The dilution technique would add sufficient water to the 25% methanol solution to dilute it to a 1% solution before discharging it to the environment. The 1% discharge solution was deemed acceptable on the basis of toxicity and on the basis of tests by environmentalists. The distillation process would have a distillate which is 70% methanol containing 98% of the test fluid methanol. This would be burned off in a special incinerator which would have emissions of carbon dioxide and water. The distillation residue would be a 1% methanol solution containing approximately 2% of the total methanol. This would be discharged or could be further reduced by placing the residue in a pond where, because of its highly biodegradable nature, it would be reduced to carbon dioxide and water. If methanol were discharged into a water course it would consume up to 1.5 times its weight in oxygen. This large oxygen demand on the receiving waters would be examined by biologists before discharge. Vol. XXXII 4165
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b-2 Station Location

- Minor relocations could be made for environmental or socio-economic reasons according to Mr. Purcell in cross-examination by CARC and COPE. The only two station locations that were of environmental concern were: (1) in Alaska where a 70 mile eastward move was suggested to avoid a Dall sheep area and, (2) a 20 mile move for a station because of ice fog dangers. None of these moves were feasible. COPE expressed concern about a station located near a fishing site in the vicinity of Aklavik. Vol. XXIX 3654-3655
Vol. XXXI 3911-3913
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Vol. XXXII 4040-4041

b-3 Station Emissions

- The ground level concentrations of emissions from the compressor stations are predicted to be less than the stipulations of the Federal Clean Air Act according to Mr. Koskimaki. The Pasquel method was used in the Alberta DOE computer program to make these predictions. Details of the program, its input and output will be provided in the environmental phase of the Inquiry. The Vol. XXX 3735-3736
Vol. XXXI 3946-3951
Vol. XXXII 4133-4146

b-3 Station Emissions (Con't)TRANSCRIPT
REFERENCE

program did not account for temperature inversion conditions. The highest ground level concentrations were calculated under windy concentrations on a sunny day. Commission Counsel suggested this was inconsistent and it cast doubt on the validity of the computer program. In calculating the sulphur dioxide emissions, the fuel gas sulphur content was assumed to be at the maximum allowable at the pipeline input to give a 'worst case' condition. Mr. Koskimaki pointed out that this would rarely, if ever, occur.

b-4 Station Noise

- The noise level at a compressor station fence line would be 65-68 decibels (dBA) according to Mr. Koskimaki. This would correspond to the noise within 100 feet of a freeway at mid-morning. At 100 feet from the station, with no vegetation, the level would be 50 dBA which would be comparable to the noise in a suburban area at night. Cold air is a better transmitter of sound but this would be offset by shutting off the condenser fans and one generator and low temperatures. Vol. XXX
3736-3737
- The turbine is the largest single contributor to noise according to Mr. Koskimaki in cross-examination by CARC. This noise can be reduced by physically enclosing the turbine and putting silencers on the inlet and exhaust. The silencers can be upgraded with a loss in equipment efficiency and an increase in cost. The best silencers could reduce the fence line noise from 59-67 dBA to 50-53 dBA although this extra level of noise reduction was not required by the environmentalists. The effect of silencing is different for different frequencies within the sound spectrum both within and outside human hearing levels. Mr. Koskimaki agreed to supply the fence line noise levels for the Travaillant Lake compressor station which has 2 coolers and 2 condensers. Vol. XXXII
4046-4069
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3934-3941
Vol. XXXII
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3999-4001

b-5 Miscellaneous

- Vibration at compressor stations would not be a problem with the use of turbines according to Mr. Koskimaki in cross-examination by CARC. Vol. XXXI
3941
3944-3945
- The design group of NES was not responsible for the design of the waste disposal facilities at camps and stations according to Mr. Purcell. That work was done by a sub-contractor to NES who will be represented in Phase 2 of the hearings. Vol. XXXI
3882-3884
- A catalogue of the quantities and types of lubricants and coolants to be used at the stations was requested by CARC. Vol. XXXI
3932-3934
4001

C. Socio-Economic

- No specific points were raised on the socio-economic aspects of the pipeline design.

D. Miscellaneous

- | | TRANSCRIPT
REFERENCE |
|--|-------------------------|
| - The D.O.E. report expanding on its previously submitted 'Digest of Concerns' was presented to the Inquiry and its participants. | Vol. XXXI
3994-3995 |
| - Arctic Gas informed the Inquiry that Mr. Fielder will appear after the construction panel to report on his impressions of Soviet northern pipelining technology. This was in response to previous interest expressed by the Judge. | Vol. XXXI
3995-3996 |
| - The Judge heard submissions by all the participants on the timing of the presentation of evidence relating to the <u>transportation corridor</u> of which the proposed pipeline would form an integral part. CARC, COPE/ITC, the Council of Yukon Indians and the N.W.T. Indian Brotherhood and Métis Association were united in their view that this evidence should be called immediately after the Engineering Phase and before the Environmental Phase. Foothills indicated that it had no strong views on the timing. Arctic Gas indicated that it could not be prepared to call evidence until after phase 4 and it would be premature to call the corridor evidence before the evidence of all the other phases was heard. The Judge, after listening to arguments on why the corridor evidence was or was not immediately necessary, suggested that if this evidence were to be heard after phase 1, it might be necessary for CARC and the Council for Yukon Indians to lead the evidence. A final ruling on the timing of the corridor evidence will be forthcoming. | Vol. XXXII
4168-4225 |

E. Inquiry Schedule

The Construction Panel will give evidence and be cross-examined starting April 21st until adjournment on April 23rd and then will resume on May 12th. The Construction Panel will consist of:

Mr. P.H. Dau, Mr. G.L. Williams, Mr. J.R. O'Rourke

The future schedule as it now stands (tentative) is as follows:

May 12th:	Hearings to resume in Yellowknife.
May 12 - 27th:	Construction Panel, Operations and Maintenance Panel and Mr. Horte of Arctic Gas to appear.
May 28 - 31st:	Community hearings in Hay River and (perhaps) Pine Point.
June 2 - 7th:	Evidence to be led by the Environmental Protection Board and further evidence from Mr. Horte if necessary.
June 7 - 15th:	Adjournment.
June 16 - 21st:	Hearings in Whitehorse (perhaps).
June 23 - July 7:	Two weeks of community hearings.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES XXXIII TO XXXIX)

ARCTIC GAS CONSTRUCTION PLAN

YELLOWKNIFE, N.W.T.

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TOPIC: Phase I: Engineering and Construction of Proposed Pipeline
 Panel on: Construction Plan (section 13a of the application)
DATE: April 21 to 23 and May 12 to 15 in Yellowknife

WITNESSES: Panel on the Construction Plan:

- Mr. P.H. Dau: President, Northern Engineering Services Co. Ltd. (NES)
- Mr. G.L. Williams: Director of Field Services, NES
- Mr. J.R. O'Rourke: (until recently) Co-Ordinator, Pipeline Logistics Planning, CNR; (now) Manager of Industrial Development, Mountain Region, CNR
- Dr. R.L. Harlan: Senior Engineer, R.M. Hardy & Associates

HIGHLIGHTS

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REFERENCE

A. Technical/Engineering

a-1 General

- The objectives of the construction plan, according to Mr. Dau, are: (1) to complete the pipeline in a reasonable period of time, (2) to build the pipeline consistent with good engineering practice, (3) to plan construction so it is acceptable to the interests of people living in the North and, (4) to maximize the protection of the environment. In cross-examination by the Council for Yukon Indians (CYI), Mr. Dau indicated the plan was in development since 1969/70 and was finalized, as filed, in 1974. In response to questions on what interests of northern residents were considered, he indicated that, where possible, major facilities such as docks and wharves were located so that they would be of use to communities after construction. He conceded that traplines were so numerous that they couldn't be avoided and in final design some changes may be required. Vol. XXXIII 4231-4232
- The construction schedule as filed has subsequently been revised to indicate a one year delay in system start-up according to Mr. Dau. This plan is now unlikely to be met. Assuming approvals from the regulatory bodies in late 1975 or early 1976, one year would have to be added to the revised schedule. (i.e. two years to the schedule as filed). Vol. XXXIII 4232-4237
- The construction plan was outlined by Mr. Dau by referring to schedules in the application. There would be 9 construction spreads of which 5 spreads would work 2 winters and 1 summer Vol. XXXIII 4237-4247

(a) Technical/Engineering (Cont'd)TRANSCRIPT
REFERENCE

- and 4 spreads (in north) would work 2 winter seasons only. The work would average out to 1 mile per working day in the winter and 1.25 miles in the summer. The schedule has allowed for a considerable number of non-productive days. All major construction camps would be located at future compressor station sites, which are about 40 miles apart, or at working pads adjacent to river crossings.
- The Alaskan oil pipeline is being observed by Arctic Gas according to Mr. Dau in cross-examination by CARC but, apart from earthwork and logistics of supply via the Berring Sea route, the construction techniques are quite different from the Arctic Gas proposal.
 - The main steps in pipeline construction as described by Mr. Dau are: surveying, clearing, grading, stringing, bending, ditching, welding, coating, lowering, controlling buoyancy, backfilling, cleaning-up and revegetating.

Vol. XXXIV
4418-4419Vol. XXXVIII
4923-4925Vol. XXXIII
4335a-2 Scheduling the Work

- If regulator approvals were obtained in the first quarter of 1976, Mr. Dau suggested to Commission Counsel that the surveying would be done in the summer of 1976 resulting in final design and specifications late that same year.
- The average winter construction periods were described by Mr. Dau for the Council for Yukon Indians as follows: (1) in the north - December 1 to April 15, (2) in the south December 15 to March 20. The summer construction where planned would generally be from June 1 to October 31. This timing allows for breakup and freeze-up, adverse weather conditions, down time which may be required for environmental reasons, holidays, etc. The compressor station construction would be done on pads and could possibly continue year round depending on the particular conditions at each site, such as access to borrow pits, etc. Using the example of construction spread F (which does work in the Yukon and the N.W.T.) in its third winter season, Mr. Dau explained it would work a total of 136 days (December 1 to April 15) of which 92 were 'working' days and 44 were judged to be non-productive. This would require a production of 0.44 miles per calendar day or 0.64 miles per working day using a twelve hour shift. The influence of darkness, low temperatures etc. was considered in allocating the miles per spread.

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a-2 Scheduling the Work (Cont'd)TRANSCRIPT
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- The productivity factors applied to each construction spread's capability to perform on working days were based on summer prairie productivity equals 1 according to Mr. Dau in cross-examination by the Council of Yukon Indians (CYI). On that basis, productivity along the north slope (coast) was assumed to be 0.6, in the Inuvik area 0.7 and in the balance of the area north of the 60th parallel 0.9
Vol. XXXIV
4433-4435
- The nonproductive days were based on a conservative estimate after consultation with contractors and from NES information sources, according to Mr. Dau in cross-examination by Commission Counsel. Although this was similar to the method of determining the productivity factors, it was conceded that the determination was drawn from very little precedent.
Vol. XXXIX
5167-5171
- The nonproductive days for spreads on the North Slope were estimated to be about 44 per season according to Mr. Dau in cross-examination by the CYI and COPE/ITC. Further south this gradually reduces to 31 days. In general, machinery downtime was not included in these figures since each spread would have spare equipment (such as a ditcher) and, if necessary, spare equipment could be borrowed from adjacent spreads.
Vol. XXXV
4550-4558
- Catching up lost productivity on a spread would be done by adding men and double shifting if required, according to Mr. Dau in cross-examination by Commission Counsel and COPE/ITC. There would be no need to move in extra equipment since spare equipment would be on site and camp facilities would be sufficient to handle the added manpower. It was emphasized by Mr. Dau that if catch-up was required, it would probably be only in one area (welding or ditching, etc.) and would not mean a complete doubling of a spread. An alternative might be to have the adjacent spread do more work since they work toward each other. Detailed contingency plans are not yet developed.
Vol. XXXVII
4737-4741
- The amount of work that can be done per spread was determined after receiving opinions from eight contractors hired to examine one or more sections of the project, according to Mr. Dau in cross-examination by Commission Counsel. The contractors had various opinions on the crew sizes, equipment and production of each section and NES made the final judgement based on all the opinions. Commission Counsel asked to see the contractors reports and suggested that it was in the owners interests to be conservative and overestimate the number of spreads required on the project.
Vol. XXXVII
4776-4780
Vol. XXXIX
5058-5062
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a-3 Logistics (Cont'd)

- The moving of materials through the Yukon was described in detail by Mr. O'Rourke in response to a request by the Judge. The impact would depend on the choice of the coastal or interior route. If the prime (coastal) route were chosen, there would be little impact since material would go either by Hay River or by the Berring Strait to the Coast and Delta. If the interior route was selected, most of the materials would still come via Hay River to Arctic Red and the Dempster (MP 286) but some could come via Skagway to an interim stockpile at Whitehorse and then transferred to a stockpile on the Dempster (MP 258). The final decision on the routing of the materials would depend on the competitive bidding of the various carriers.
- The offloading facility at Arctic Red would handle material for more than three spreads if the interior route were chosen, according to Mr. O'Rourke in response to Foothills. This would be a transfer point only and would not house men or stockpile materials. Trucks would haul the material along the Dempster Highway to stockpile sites. The plan assumes that overlength and overweight permits could be obtained for the highway.
- The tonnages and classification of materials to be transported each year in Canada north of the 60th parallel were given in tabular form and described by Mr. O'Rourke.
- The normal increase in barging tonnage on the Mackenzie River system was assumed to be 25% per year over the construction period of the project, according to Mr. O'Rourke, and this was assumed to be handled as normal growth by the barging companies and would be utilized to capacity as normal growth in supplying communities, exploration, etc. Thus, the construction of the pipeline will require the addition of barging facilities since existing and 'normal growth' capacity will not be available. The addition of 8 tugs and 48 barges (8 tows) required for the pipeline would double the tonnage capacity of the existing system. The largest single tonnage component would be pipe and the additional barging capacity was based on the assumption that this pipe would all be routed through Hay River.
- The lead time required to have the new barges and tugs in position at the start of materials shipping is 24 months, according to Mr. O'Rourke. This has and is being discussed between Arctic Gas and the barging companies and a second opinion is being sought by Arctic Gas to confirm that west coast shipyards have the capability to manufacture the vessels in time. Financial commitments would have to be made by mid 1975 to make the start of

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a-3 Logistics (Cont'd)TRANSCRIPT
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- shipping schedule as now proposed in the construction plan.
- Dredging of the Mackenzie River and the proposed offloading points was not considered when determining the number of barges and tugs required, although if it did take place, it could increase the barge load capacity, according to Mr. Dau. It was assumed that there would be no dredging although NES is aware of NTCL's desire to have it done. Vol. XXXVII
4723-4725
4730-4731
4815-4816
 - The wharf locations and associated stockpile sites are only known in general terms according to Mr. Dau in cross-examination by CARC. The final location will be known 6 months before start of shipping and after consultation with the communities, the operators and D.P.W. who issue the permits. Of the 20 wharfing facilities required, five exist and require upgrading (Swimming Point, Inuvik, Fort Good Hope, Norman Wells and Fort Norman). Apart from Norman Wells, the 'upgrading' may mean establishment of an entirely new facility. All wharves would be maintained by the applicant but could be shared by other users at non peak shipping periods. Vol. XXXVIII
4325-4326
Vol. XXXVIII
4857-4861
 - Although barging is presently the preferred mode of transport for most of the materials because of cost, according to Mr. O'Rourke a combination of modes and routes may ultimately be used. The present plan for materials south of Fort Simpson calls for trucking from Hay River to the various points along the right of way. In general, economics dictates the location of staging areas and wherever possible, changing from one mode to another is avoided. Vol. XXXIX
5033-5036
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4790-4797
 - The existence of the Mackenzie Valley highway would not reduce the cost of the pipeline in a "substantial way" according to Mr. Dau in cross-examination by the N.W.T. Indian Brotherhood who referred to a 1972 speech by the Prime Minister stating that the pipeline cost would be reduced because of the highway. Mr. Dau disputed the figures quote from an AGTL/CNR study indicating that the savings resulting from the highway would be \$18.44 million which was said to be 60% of the cost of the road. Vol. XXXV
4614-4618
 - The construction plan did assume the highway would be built to Fort Good Hope but since trucking is only planned as far as Fort Simpson, the amount of highway completed beyond there would not greatly affect construction. It would affect the location of stockpile sites and the need for air strips at otherwise inaccessible compressor station. Vol. XXXVIII
4258-4264
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5057-5058
 - The Dempster Highway would not be used unless the interior route were chosen according to Mr. Dau and Mr. O'Rourke in response to the Judges questioning. Foothills cross-examination showed that if the Dempster Highway were used Vol. XXXVIII
4252-4254
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4544-4547

a-3 Logistics (Cont'd)TRANSCRIPT
REFERENCE

- to deliver materials from Arctic Red to the right-of-way, the number of tractor trucks would have to be increased beyond that given in the application and supporting documents.
- The location of temporary construction roads as shown on the alignment sheets are approximate, according to Mr. Dau in cross-examination by CARC. The exact number and location of the temporary and snow roads won't be known until the survey is completed one year before construction. Vol. XXXVIII
4861-4864
 - The CNR has 400-89 foot deck multipurpose flat cars on order which would be used in hauling the pipe for the proposed pipeline according to Mr. O'Rourke. The existing rolling stock (using 52 foot idlers) would be insufficient to handle the volume of pipe envisaged. The rail sidings and staging area in Hay River would be up-graded, probably by NTCL. Vol. XXXIII
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4264-4265
 - The air support requirements for the pipeline as proposed call for sixteen 2,400 ft. airstrips and five 6,000 ft. airstrips equipped with IFR facilities according to Mr. O'Rourke. The existing strips at Inuvik, Norman Wells and Hay River would be used and the strips at Fort Norman, Fort Good Hope and Wrigley would be upgraded. Personnel and supplies would be flown to these strips by contract carriers such as PWA and Northward Aviation. Vol. XXXIX
5051-5056

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a-4 Routing

- The cross delta route is favoured by Arctic Gas over the other routes from an economic and engineering viewpoint according to Mr. Genest in response to the Judge's questions. The final decision is awaiting this years' environmental studies. Vol. XXXVII
4748-4749
- The Offshore alternative (in the Beaufort Sea from Prudhoe Bay to the Yukon) has not been studied from a logistics point of view, according to Mr. O'Rourke in cross-examination by Mr. Bayly. Mr. Dau explained the general technique of pipe installation from a lay barge such as would be used if an offshore route were used. Vol. XXXVIII
4752-4755

a-5 Surveying

- The four survey phases were described by Mr. Dau as: 1) location, 2) construction, 3) as built and 4) legal. The location survey would utilize orthophotomosaic mapping techniques which are to be tested near Fort Good Hope this summer. The Vol. XXXIII
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4953-4956

a-5 Surveying (Cont'd)TRANSCRIPT
REFERENCE

construction survey would flag the right-of-way and ditch center line. The as built survey would locate all permanent items prior to burial. The legal survey would be done in accordance with regulations.

- The survey crew size and techniques were described by Mr. Williams in cross-examination by the N.W.T. Indian Brotherhood and Commission Counsel. Of the eight systems of survey available, NES would recommend that wherever possible clearing be by hand in summer with crews living on river barges supported by helicopters. There would be one survey crew of twenty or less per spread per season. The advantages of summer survey is that the drainage studies, permafrost probes and geophysical work would be more effective.

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a-6 Clearing

- Clearing should be done by hand wherever economically feasible according to Mr. Williams in cross-examination by Commission Counsel. In order of increasing impact, the possible techniques are 1) hand, 2) machine and 3) grading. All areas designated for arctic construction techniques would be hand cleared with conventional construction areas hand cleared to the greatest economic extent possible. The criteria used to evaluate the need for hand or machine clearing are: 1) the terrain, 2) the potential damage to the surface cover, 3) the existence of high ice content soils, 4) the availability of manpower, 5) the housing of crews. There has been no rule established as on the maximum degree of slope beyond which clearing should be done by hand. The machine clearing (in winter) would be done by cats equipped with roam blades and shoes to protect the ground cover.
- The clearing crews would vary in size from 27 to 66 according to Mr. Williams in cross-examination by Commission Counsel. They would be housed in a small mobile camp if they were a year ahead of the main construction or, as part of a larger construction camp if they were in the vicinity of construction.
- The disposal of clearing slash would be controlled by (1) hauling it to a borrow pit, (2) burning it (in special sleds in permafrost areas) or (3) chipping it and either blowing the chips over the right-of-way or hauling them away. The recommendations on which technique to be used in a particular area have not yet been made.

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a-7 Snow RoadsTRANSCRIPT
REFERENCE

- An outline of snow roads for this project was presented by Mr. Williams. Generally, snow roads would be used north of the 65th latitude and would be of two types: (1) dense 32 foot roads for access to the right-of-way and traffic along it, (2) less dense working surface roads for the slow moving construction equipment. The Inuvik snow road test site was described. The 0.75 mile route was hand cleared in October 1973 and the surface vegetation compacted with low ground pressure vehicles to induce freezing of the active layer. Since snowfall was very light, snow was harvested from Dolomite Lake and then dumped on the right-of-way where it was spread by a D-6 and densified by a rotary plough cultimixer. Trafficability tests were then done and, where necessary, repairs were made with a mixture of sawdust, snow and water (snowcrete). Tests were also done on manufacturing snow to be used for construction early in the season or for reinforcing creek crossings. Tests were also done on the road as it deteriorated in the spring. The tests at Inuvik verified the viability of snow roads and indicated that they would cost \$30,000 to \$40,000 per mile.

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4304-4323
- The snow road construction would begin as early in the fall as weather conditions would permit, according to Mr. Williams. The initial requirement would be: (1) 8 to 10 inches of frozen ground (active layer), (2) 4-6 inches (minimum) of compacted snow to start construction. If natural snowfall was insufficient, it could be supplemented by: (1) making snow, (2) harvesting snow, or (3) accumulating snow using snow fences. If snow making equipment were used, it would be placed at the water source the winter before construction so it would be on site in the fall of the construction season. It would then build its own snow road to and along the right-of-way. The equipment at Inuvik produced 12,500 cubic feet of snow (31,200 gallons of water) in 31 hours but the six nozzle machines envisaged for the pipeline work would be capable of producing 20 times that amount. The Inuvik road required 18,000 cubic yards per mile.

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5028-5033
- On the North Slope of the Yukon the annual precipitation is very low and, according to cross-examination of Mr. Williams, snow road construction would have to rely mainly on snow fence accumulations along the right-of-way complemented with snow harvesting and snow making. Tests on the effectiveness of snow fencing were done at Prudhoe Bay and environmental concern of the fences inter-

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a-7 Snow Roads (Cont'd)TRANSCRIPT
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- ference with mammals will be minimized by leaving gaps in the fences. The Alyeska Pipeline doesn't utilize snow roads.
- The criteria to be used to determine when, in the spring, a snow road was no longer usable were not known to Mr. Williams when questioned by Commission Counsel, although he suggested that depth of road thaw and damage to the underlying surface vegetation could be used. Factors to be considered would be: (1) the topography of the route, (2) the type of equipment that would have to be moved out before the snow road was unusable and (3) the relief provided by lower temperatures at night. A week or ten days notice to vacate an area over the snow roads would be sufficient. In the final analysis, Mr. Williams stated that the land use inspectors would instruct the contractor to shut down his operation because of the deterioration of the snow roads.
 - The role of snow roads in the winter activities of a typical construction spread (spread C, second construction year) was described by Mr. Williams in cross-examination by CARC. Clearing would be done the previous year and snow road construction would start as early as possible with the plan based on an October first start. The early snowfall would be compacted to decrease its insulating effect and hence speed up the freezing of the active layer. If there was insufficient snow for a road, snow making would begin with ditching and stringing of pipe following as soon as possible. In a worst case condition ditching would be delayed until late November and would then progress at an average rate of 18 miles per month. The snow roads would be used through to March or April with repairs being done at night as required.
 - The maximum allowable grade on a snow road would be 9 degrees or 16 percent, according to cross-examination of Mr. Williams.
 - Winter roads and winter trails will be built to provide access in areas of non permafrost and will follow existing right-of-way clearings wherever possible, according to Mr. Dau.

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5066-5067Vol. XXXIII
4323-4325a-8 Ditching, Blasting and Backfilling

- A general description of the ditching operation and equipment was given by Mr. Williams. The trench would be a minimum of six feet wide with a depth to provide a minimum cover of 30 inches over the pipe. Deeper burial

Vol. XXXIII
4339-4355

a-8 Ditching, Blasting and Backfilling (Cont'd)TRANSCRIPT
REFERENCE

would be provided at erosion and surcharge areas determined in the field. Excavation would be by wheeled ditchers wherever possible, supplemented by blasting and backhoes. Current wheeled ditcher improvements are being made so that they can excavate a larger proportion of the trench and hence decrease the blasting/backhoe requirements.

- The current wheeled ditcher developments are aimed at proving the structural integrity of the wheel and teeth, and evaluating the horsepower, according to cross-examination of Mr. Williams by the Indian Brotherhood. North of 60° there would be 3 machines per spread - 2 working and one standby - for a total of 15 machines. The existing machines are capable of excavating 70% of the route at an average rate of 3.7 feet per min. Prolonged tests under actual anticipated ambient conditions are planned for the winter of 1975-76 near Norman Wells. The object is to increase the capability of the machines so they can excavate 90% of the line.

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- The sections of the route requiring blasting were filed as exhibit #99. According to COPE/ITC cross-examination of Mr. Williams, the blasting will be done ahead of ditching and any decision to speed up ditching by blasting, although unlikely, would be made by consultation between the owner and the contractor.

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- The pipe would be strung along the right-of-way and cold bent to fit the contour of the ditch, according to Mr. Dau. Then, buoyancy control measures, where required, would be adopted and would include: (1) continuous concrete coating (i.e. major river crossings), (2) bolt on weights (ie small river crossings), (3) saddle weights (ie muskeg) or, (4) pipe anchors (where underlying conditions permit). The pipe would be welded into 1000 foot sections and lowered into the ditch which would be smoothed out, where necessary, with a 6 inch layer of sand. The pipe would be protected during backfill, if required, by a rock shield and all spoil would be mounded over the trench. Some select borrow would be used at bends, road crossings, drainage and erosion control works etc.

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a-9 River and Highway Crossings

- 'Major' river crossings (those specially contracted out) such as the three Mackenzie River crossings and the Peel and Bear River crossings would be done in the summer, according to Mr. Dau. 'Minor' river crossings (those done by the mainline contractor) would be done during the winter

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a-9 River and Highway Crossings (Cont'd)TRANSCRIPT
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by lowering the pipe into the ditch through the ice.

- The sequence of installing a typical 'major' river crossing was described by Mr. Dau. If blasting were required, it would be done the preceding winter through the ice and excavation would take place in the summer and fall. Spoil from the excavation would be placed on the downstream side of the trench. The pipe would be welded together on the banks or, where the banks were steep, on a berm in the river, and then pulled across with floatation cylinders attached to keep it just off the bottom. When properly positioned, the cylinders would be removed and the trench backfilled with the spoil or the berm material.
- The crossing of Shallow Bay as envisaged in the cross Delta route was described by Mr. Dau for COPE/ITC. Since it is a major water crossing, a special contractor would be used. After hydraulic dredging in the late summer and fall (timed to avoid the whales) the pipe would be fabricated on work pads on both sides of the crossing and pulled across the Bay.
- Road and highway crossings would be done by the open cut method wherever possible and the pipe under the road protected in a 56 inch casing, according to Mr. Dau. Railroad crossing would be bored.

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a-10 Welding, Coating and Wrapping

- Pipe will be double jointed using automatic welders at Hay River before barging them to the northern stockpile sites according to Mr. Dau. Pipe at the ditch will therefore be in 60 or 80 foot lengths.
- One weld would have to be done every 10 minutes, according to Foothills, if one mile of pipe were laid per day. Mr. Dau indicated that automatic welding was now under study and experience with it in the North sea and Europe show that it is capable of 6 to 8 welds per hour on a 48 inch 0.75 wall pipe. Although automatic welding is not common on Canadian pipelines, Arctic Gas is hopeful that the experience gained with it in Alaska will prove its viability for this pipeline. Arctic Gas's present planning still relies on manual welding and would require 1000 suitably qualified welders at peak construction. Although not available today, Mr. Dau

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a-10 Welding, Coating and Wrapping (Cont'd)

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- quoted a report which indicated that other classes of welders could be upgraded to meet the requirements. All welds would be subjected to radiographic or ultrasonic non-destructive testing.
- Double joint welding would be carried out at the stockpile sites along the Dempster Highway if 40 foot lengths of pipe were used on the Interior route, according to cross-examination of Mr. Dau by Foothills. It would probably be done in the summer, using automatic welding machines, by technicians under the supervision of a qualified welder.
 - The adverse weather conditions under which the welding would have to take place were considered in the scheduling of the project according to Mr. Williams in cross-examination by CARC. Further tests are planned but experience in Northern Alberta show that it will not be a problem.
 - The decision on the type of coating/wrapping to be utilized will be made as part of final design according to Mr. Dau. Foothills suggested that if the pipeline tape were used, 660 squares (one square equals 100 square feet of tape) would be required per mile and the total Canadian production is no more than 3 million squares.

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a-11 Pipeline Testing

- The pipeline would be tested hydrostatically and with the use of a 'smart pig' as described by previous panels, according to Mr. Dau.

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a-12 Compressor Stations

- Compressor and metering stations would be constructed in both winter and summer wherever possible according to Mr. Dau. The gravel pads would initially serve the storage and construction camp requirements. Permanent station building would be prefabricated and mechanical, electrical and other components would be prefabricated in modules as much as possible.

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a-13 Other Project Requirements

- The major construction equipment requirements for the project as listed in the application, were referred to by Mr. Williams. It included, 700 crawler type tractors (including tracked LGP units), 400 earth moving and excavating units, 300 compressor/drill units, 650 manual welding units, 100 bending machines, crushers, etc., 350 tractor trucks and trailers (including

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a-13 Other Project Requirements (Cont'd)TRANSCRIPT
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wheeled LGV vehicles), 200 5 to 16 ton class trucks and 1300 half ton to five ton trucks. Of the above equipment, enough for 7 of the 9 spreads is now owned by pipeline contractors. The 2 additional spreads would have to be provided by a general expansion of the industry.

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- The fuel required for construction (diesel, gasoline, aviation fuel, heating oil and propane) would be transported by barge from Hay River to the stockpile sites where, according to Mr. Dau, it would be stores in bladder tanks (volumes up to 1,500 barrels) or steel tanks (volumes up to 5,000 barrels) or, in the case of propane in 900 gallon tanks.
- The labour requirements for the entire project were summarized (section 13.a.5.0 of the application) by Mr. Dau. The peak winter (second) would have 7,500 men working and the peak summer (second) would have 5,400 workers. Those figures do not include construction managers, engineers, etc. which is estimated at about 1200 during the peak period.
- The construction camps, as described by Mr. Dau, were divided into three categories by size. 1) Preconstruction camps for ten to fifty men which are mobile by helicopter, barge or all terrain vehicle. 2) Fifty to two hundred man camps for use up to one year and which eventually form part of the larger construction camps, 3) Two to seven hundred man camps for major construction and located at unloading facilities or compressor station sites. Location of the camps is shown on the alignment sheets.
- The preferred and alternate borrow requirements are shown on the maps but a final decision on sources and quantities will not be made before further drilling is done or possibly until during construction, according to Mr. Dau in cross-examination by CARC. The location of crushers, trench areas requiring select backfill, and sources of concrete aggregate won't be known until after final design and in some instances until after construction has started. The total granular requirements North of 60° for roads, airstrips, pads, etc. is estimated at 28 million cubic yards.
- Concrete weights used for buoyancy control would be made at stockpile sites or borrow pits near to where they would be required, according to Mr. Dau.

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a-14 Design ManualTRANSCRIPT
REFERENCE

- The final mile by mile design will be based on the ground truthing survey work and the design manual, which will be developed to apply design solutions to particular conditions, according to Mr. Dau in cross-examination by Commission Counsel. The manual is now under preparation but it will not be completed for about another year. Commission Counsel suggested that any completed parts of the manual would be of great help to the Inquiry. Any field design changes will be made by qualified people on site and not the contractor.

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a-15 Construction Examples

Note: In order to fully understand the details of the pipeline construction, the various participants requested information on specific construction spreads. These included spreads with camps near Old Crow, Komakuk Beach, and near the Delta. These are referred to below. In answer to requests made by the participants, Arctic Gas undertook to supply an activity and manpower schedule for typical spreads - marked as exhibit 118 (Vol. XXXIV page 4428-4433 and Vol. XXXVII page 4706)

a-15-1 Old Crow (A)

- Camp A (800 men) is located about 12 miles from Old Crow rather than at a compressor station site because, according to Mr. Dau in cross-examination by the CYI, that location is on an existing winter trail which can be used to get pipe and equipment from the Dempster Highway and it is close enough to Old Crow to permit use of that airstrip for the supply of groceries, spare parts and personnel. The native fishery south of the area was not considered but NES was aware of the muskrat and caribou in the area and located the camp and pipeline to stay as far away as possible. The CYI suggested that the temporary snow road from the Dempster could develop into a permanent one and could affect the caribou. They also pointed out that it went near to the Klokut and Old Chief archaeological sites. Mr. Williams indicated that the route could be diverted around these areas. Blasting would only take place in the winter and could be scheduled to minimize the impact on caribou.
- Old Crow is shown on the maps as being in Alaska according to the CYI. Mr. Williams indicated this was a drafting error.

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a-15-2 Spread 'C'

- During the second winter of construction Spread Camp C is located near Fort Good Hope and finishes its work at compressor

a-15-2 Spread 'C' (Cont'd)TRANSCRIPT
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station MO-09 at MP 400. It then moves to the northern Yukon to work in the third winter of construction from a camp at Komakuk Beach.

- During the second winter of construction spread C will build 81 miles in the N.W.T. Mr. Williams in response to questioning by CARC agreed that weather was the main unknown in the planning but pointed out that this had been taken into account in the scheduling of welding, stringing of pipe etc. The schedule assumed that the highway was completed to Fort Good Hope and that demobilization of the camp would occur at the end of April. Mr. Williams agreed that without the highway it would be a 'crunch' to demobilize. CARC pointed out that April 10th was the normal cut-off date for land use permits in that area and the Arctic Gas plan shows demobilization later than that. It was Mr. William's opinion that the previous permits did not consider snow roads. He suggested that equipment would start to be removed out as soon as it was free and that only the last pieces would be moving at the last time shown. If equipment got stuck other arrangements would be made.

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- During the third summer, spread C would be based at Komakuk Beach. Komakuk Beach was selected, according to Mr. Williams, because it was on the coast, was an area that had been previously used by the DEW line, was acceptable to the ornithologists and permitted an early fall start because it wasn't necessary to wait for the Malcolm River freeze-up. The first activity there would be surveying followed by the establishment of a stockpile site. The survey crew would consist of 10 to 50 men, the crew for the compressor station construction would number about 200 and the stock pile staff would be from 50 to 100. The CYI pointed out that the work scheduled for spread camps C and E left a 10 mile gap in the pipeline between them. Mr. Williams suggested that this was a typographical error and, if such a thing did occur in construction, it would be handled through the normal oversupply of pipe, pipe from adjacent spreads, or extra pipe could be flown in.

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a-15-3 MP 0 - MP 140

- The construction camp for the spread from MP 0 to MP 140 would be located on the east side of the east channel according to

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a-15-3 MP 0 - MP 140 (Cont'd)

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cross-examination of Mr. Dau by Commission Counsel. The initial work would be to build the 24 miles from MP 0 to the camp. If there was insufficient snow for roads, it might be necessary to do the work backwards but this is not desirable. The camp would be moved across the east channel during February of the first construction winter by building an ice bridge. The steep east bank would probably require the construction of a sho fly - a road off the pipeline right-of-way to go around difficult terrain.

B. Environmental

b-1 Approvals & Review

- The final decisions on construction resource requirements such as borrow pits, water sources/quantities, detailed facility location, construction techniques, etc., may not be made until later in the design process and perhaps not until construction is under way, according to Mr. Dau in cross-examination by CARC. Many of these aspects of construction require approval under the Territorial Lands Act and the Northern Inland Waters Act and these approvals were considered in developing the proposed schedule. CARC pointed out that approvals under these regulations require identification of sources and quantities in more exact terms than provided in the application. Mr. Genest (counsel for Arctic Gas) pointed out that the application before the Minister of Indian and Northern Affairs "is an application not only for a right-of-way, but for all permits, authorizations and approvals that the applicant may require to construct and operate and maintain the pipeline...."
- The design review process is an ongoing NES responsibility, according to Mr. Dau, and no detailed review process by the government or independent agency such as for the Alyeska project has been contemplated except for the review by the NEB when granting leave to construct.

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b-2 Project Control

- Control of construction would rest with the applicant, according to Mr. Dau, and would be exercised by: (1) direct supervision of contractors and detailed planning, co-ordination, inspection and testing,

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b-2 Project Control (Cont'd)TRANSCRIPT
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- (2) directly providing all camps and facilities such as waste treatment works, (3) control of budgeting, right-of-way and permit acquisition, (4) responsibility for procurement and supply, (5) detailed specifications, (6) overall scheduling (7) land use control and the applicants own environmental and socio-economic inspectors, (8) authority to stop work and (9) instruction of workers in northern environments and cultures. Mr. Dau explained to the Indian Brotherhood that each spread would have a person with the authority to stop the work and such authority would be backed by contractor contractual agreements. However, Mr. Dau agreed with Commission Counsel that if the work got behind the pressure to catch up may result in environmental protection measures receiving a low priority-particularly in view of the fact that the environmental inspectors would be working for the applicant who would want the job caught up and finished.
- The amount of detailed environmental stipulations to be written into the contracts has not been studied yet, according to Mr. Dau in cross-examination by Commission Counsel. NES would be recommending to Arctic Gas that seasonal environmental sensitivities such as caribou calving etc. be included. These recommendations are not expected for about a year.
 - The role of the environmental and socio-economic inspectors and their relationship to the engineering inspectors was dealt with by the CYI in cross-examination of Mr. Dau. It was explained that all such inspectors would report to Arctic Gas and they could, on an individual spread basis, order a stop to the work through reports to the Arctic Gas manager on site.
 - In addition, there would be government inspectors. The total number of inspectors per spread would be about 15.
 - The Environmental Protection Board's recommendations on construction supervision in the Yukon arrived after the submitted plans were finalized, according to Mr. Dau, in cross-examination by the CYI, but environmental consultants recommendations were considered. For example, construction schedules were planned to minimize interference with caribou migration. Although not considered in determining the number of non-productive days per spread, construction could be shut
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b-2 Project Control (Cont'd)TRANSCRIPT
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down for caribou migration if it did occur. The ditch would be back-filled and gaps provided in the strung pipe.

b-3 Environmental Consultants

- The environmental consultants retained by NES were named by Mr. Dau for the CYI. They were: (1) L.G.L. Ltd (birds), (2) Renewable Resources (mammals), (3) Aquatic Environments (fish), (4) Dr. Banfield (overall consultant). The CYI requested that when representatives of these consultants appear, they be the same ones that attended the April 1973 meeting at which the environmental tradeoffs were made.

Vol. XXXIV
4454-4457b-4 Routing

- The considerations other than terrain that were involved in the Fort Simpson Amendment were described by Mr. Williams in response to a previous request by the Judge to explain how the route was moved to avoid environmentally sensitive areas. The amended route eliminates the crossing above the Liard confluence, decreases the truck haul miles south of the Mackenzie and, when the decision to dual major river crossings was made, the analysis showed a cost saving in the amended route. In late 1973, NES engaged Pentzien, a river crossing contractor, to comment on and to cost 6 major river crossings. Their report contained in the NES report of July 1974 recommended dual crossings on the Mackenzie and Liard. This led to the routing change even though it was longer and through more muskeg.
- The four criteria used in establishing the construction plan (see a-1 above) were not listed in order of priority according to Mr. Dau in cross-examination by the CYI. In no case were any environmental aspects ignored and all efforts were taken to minimize disruption to the environment.

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4393-4396b-5 Right-of-Way

- The need for a 120 foot cleared right-of-way was questioned by CARC and Commission Counsel. Mr. Dau explained that a narrower right-of-way had not been fully investigated, but a narrower working area than shown would be restrictive and would affect the work schedule. It was pointed out by CARC that

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b-5 Right-of-Way (Cont'd)TRANSCRIPT
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in places the right-of-way for the Alyeska project is only 55 feet. Mr. Dau indicated that in areas where the road was not on the right-of-way, or where the organic matter was not stripped and piled on the right-of-way, the full 120 feet would not be cleared.

b-6 Construction Techniques

- The two construction techniques to be used, are (a) conventional or (b) arctic, according to Mr. Dau. The Conventional technique would generally be used south of the 60° parallel and involves right-of-way grading, snow removal (except over the ditch line) to induce freezing, and ditch excavation from the graded frozen ground surface. The arctic construction technique would be used in sensitive permafrost areas to prevent permafrost degradation and involves building snow working surfaces/roads over the ground vegetation without grading. The arctic technique is more expensive and would be used on a site specific basis in the discontinuous permafrost zone. If required, the techniques could be altered for 300 foot stretches.
- The technique to be used in a particular location won't be known until after the field surveys are completed and, in some minor cases, until construction starts, according to cross-examination of Mr. Dau by CARC. The field geotechnical engineer with input from environmentalists would make the field decisions on where to change construction techniques. Similar types of equipment would be required for each technique except for the snow making machines required in Arctic type construction.
- The exact cut-off point of each type of construction can't be given, according to Mr. Dau in cross-examination by Commission Counsel. The area south of Fort Norman was described as largely without sensitive permafrost and hence conducive to conventional techniques. In reference to a specific area on the spread sheets, Dr. Harlan explained that the RKM terrain type (speckled bog) would probably be traversed using the conventional construction technique.

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b-7 Snow Roads

- Tracked vehicles would be slightly more harmful to snow roads than the wheeled vehicles used in the tests on the Inuvik snow road, according to

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b-7 Snow Roads (Cont'd)TRANSCRIPT
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Mr. Williams in cross-examination by COPE/ITC. The right-of-way working surface snow road would be natural snowfall compacted to protect the vegetation and wouldn't be as thick as the traffic snow road. The owner would want to stop using the working surface snow roads if the right-of-way was going to be damaged because of the increased maintenance costs. No chemical binders would be used in repairing the snow roads. Mr. Williams indicated lakes would be studied before using them to harvest snow and those that were shallow (freeze to bottom) and didn't support fish would be designated. It was confirmed that a literature survey on the effects of snow removal on North Slope lakes was underway and further monitoring of the vegetation at the Inuvik snow road test site is scheduled for this summer.

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- The potential snow road damage to lichens if there was no other plant cover to protect them was not studied by NES, according to Mr. Williams when questioned by ITC/COPE, although they had looked at experience elsewhere. NES had done no studies to assess the effect of snow roads in the same location for two or more successive seasons but they assumed this would be very minimal.
- The water sources used for making snow would be identified, according to Mr. Williams, prior to construction with environmental concerns taken into account. Some decisions would be made in the field and the quantities to be extracted from each source wouldn't be known until construction. Similarly, decisions on filling of slopes will be made partly at the design stage and partly during construction.
- The probable worst case for the number of passes on a snow road would be such as at the Komakuk Beach access road which would be travelled 45,000 times in one season, according to Mr. Dau. The right-of-way would have about 29,000 passes.

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b-8 River Crossings

- The major river crossing techniques have been identified as either A,B or C as described in the application, according to Messrs. Dau and Williams in cross-examination by CARC. Although there may be changes in final design, the present

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b-8 River Crossings (Cont'd)TRANSCRIPT
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plans call for technique A on the Mackenzie River and B on the Bear River. The environmentalists are most concerned about technique B. The Judge suggested that if any participant wanted to urge that a particular technique be adopted, they should suggest that as one of the terms and conditions. CARC indicated that they would be calling evidence on this issue.

- The environmental aspects of the Bear River crossing were explored by CARC in cross-examination of Mr. Williams. Blasting would be done between January and March with excavation and pipe installation the following summer between July first and the end of September. The whitefish and greyling would be migrating past the area during the construction but Mr. Williams did not recall that their environmentalists had any specific recommendations.

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- The method of disposing of the excavated material at the Point Separation crossing was the subject of Commission Counsel's cross-examination of Mr. Williams. The alternatives were dredging the trench with: (1) discharge of spoil at the river surface causing a 3 ft mound downstream of the excavation, (2) discharge of spoil about 10 feet from the streambed resulting in a 10 ft mound or (3) disposing of the spoil near the shore and re-using it as backfill. The first two techniques are preferred by NWS and their environmentalists advise that the silting problem would not be significant since the river carries a large amount of silt anyway.

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- The Swimming Point river crossing excavation would have a silting situation similar to the Point Separation crossing, according to cross-examination of Mr. Williams by Commission Counsel. Some blasting of the permafrost may be required in the winter and the excavated material would be deposited in a shallow water area and downstream of the excavation. Commission Counsel pointed out that a commercial native fishery is located near the site.

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b-9 Surface Drainage and Erosion

- The erosion designations used on the alignment sheets, as described by Dr. Harlan in cross-examination by Commission Counsel, are preliminary only and grouped as: (1) 4 categories (EC1 to EC4) used to describe erodability and slope conditions and, (2) EC5 to EC8 used to designate special terrain and construction conditions. Erosion

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b-9 Surface Drainage and Erosion (Cont'd)TRANSCRIPT
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can be defined in terms of the volume and velocity of water required to transport soil and depends on soil grain size, binding medium and thermal considerations. There was no correlation between erodability and the construction techniques planned (see b-6). The designs are for bare soil (worst case) conditions. The settling of the trench backfill could disrupt drainage and hence cause erosion problems on the right-of-way.

Windrows of debris from clearing would help control erosion until the revegetation takes hold. In Arctic areas diversion dikes, RIP-RAP, ditch plugs and mound breaks would be used. Selected backfill would be used in areas of erosion sensitive soils with a critical slope length and height. The hydraulic model now being refined was used to predict erosion using rainfall intensity/duration information and flood frequency data. The model was used to assess the cost of different designs and their related maintenance costs and hence optimize the overall proposed construction design.

- Erosion control dikes would be required off the right-of-way in some cases, according to cross-examination by Mr. Scott, but these will not be identified until the design manual is prepared. They would be the last thing constructed on the right-of-way. The method of construction of the dikes has not been decided. In cuts the erosion problem would be minimized by backfilling to the original ground surface. No consideration has been given to siltation ponds in such areas.

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b-10 Sub-Surface Drainage

- The installation of insulated culverts for subsurface water flow across the frost bulb was described by Messrs. Dau and Williams in cross-examination by Commission Counsel. Backhoes would be used to install the 50 foot culvert pipes during the winter when the water in the surface streams (i.e. the Firth River) was low. The number of such culverts at any location is not known. Mr. Williams stated that it would be difficult to install the culverts after the pipeline was operating. Such an installation would require depressurization of the pipeline. The Judge asked how El Paso planned to handle the problem of subsurface drainage.

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b-11 Revegetation and CleanupTRANSCRIPT
REFERENCE

- In continuous permafrost areas the top 18 inches of tundra would be removed prior to ditching and then replaced after construction, according to Mr. Dau. Revegetation seeding and fertilizing would be done by aircraft and on foot where required, to achieve safe and stable slopes as completely as possible. Vol. XXXIII 4352 4370-4371
- The vegetative mat removed prior to construction would be spread over the ditch and berm area, according to cross-examination of Mr. Dau by COPE/ITC. Aerial seeding would be done along the whole right-of-way and the winter roads. Vol. XXXVII 4816-4821 Vol. XXXVIII 4822-4823
- Cleanup would involve (1) the return of all excess materials to designated storage areas and, (2) the disposal by burning or burial of waste. Mr. Dau said that public, private and construction roads would be restored as required. Vol. XXXIII 4370

b-12 Aircraft Flights

- The flight altitudes and routes specified in the Biological Report Series can be complied with except for landings at compressor stations and some helicopter work, according to Mr. Dau in cross-examination by the N.W.T. Indian Brotherhood/Métis Association. Vol. XXXIV 4474-4477 4500-4502

b-13 Miscellaneous

- Detailed fuel handling procedures will be developed as well as design details for storage tank set-backs from rivers, according to Mr. Dau in cross-examination by CARC. Vol. XXXIX 5062-5064
- The handling of camp waste products was deferred to another panel by Mr. Dau in cross-examination by COPE/ITC. Vol. XXXVII 4781-4782
- The cleared brush at the Inuvik snow road test site was chipped but some was burned for experimental purposes according to Mr. Williams. Vol. XXXVIII 4827-4828
- The caribou would not be herded away from construction areas, according to Mr. Williams in cross-examination by COPE/ITC. Environmentalists would advise the applicant when the number of caribou in an area was large enough to warrant a change of construction schedule. Vol. XXXVII 4760-4763

C. Socio-Economicc-1 Communities

- Gemini North attended the April '73 meetings to present socio-economic advise on the Vol. XXXIV 4440-4446

c-1 Communities (Cont'd)TRANSCRIPT
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- routing and timing of the pipeline work, according to Mr. Dau in response to cross-examination by the CYI. They had no input for Old Crow since they were requested not to visit that community.
- Physical control of construction workers will be achieved by Arctic Gas restricting their movement, according to Mr. Dau in cross-examination by the CYI. Good camp facilities, the restricted use of vehicles and the weather would induce the men to stay at the camps. Socio-economic monitors would provide advice on contacts and involvement in communities.
 - The effect on the people of Tuktoyaktuk of the construction camp to be used if the cross delta route were used was questioned by Mr. Bayly. Counsel for Arctic Gas undertook to get details of the camp to be located on the east side of Shallow Bay.
 - Fort Good Hope would be adjacent to major construction activity including a wharf, stockpile site, a camp, borrow pits, and a communications tower, according to Mr. Williams in cross-examination by Commission Counsel. The stockpile site and the haul road would be 2 miles from the community. Adjacent to the stockpile site there would be a 800 man camp. The initial recommendations of the socio-economic advisors is now being reviewed and an alternative site 3 or 4 miles further away is being considered. The wharf to be built near Good Hope would be owned by Arctic Gas but no decision has yet been made on the sharing arrangements with the community. The Judge suggested that such arrangements could be argued by the Inquiry participants as a condition of granting the right-of-way.
 - The Fort Simpson amendment made very little change in the socio-economic impact at Fort Simpson, although it did marginally improve the economics of bringing gas to the community.

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4477-4482Vol. XXXVII
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4712c-2 Transportation and Logistics

- The disruption of existing supply facilities will be minimized by planning, according to Mr. Dau in cross-examination by ITC/COPE. PWA has indicated that it could handle the extra movements of men and materials either with aircraft now on order or otherwise available. No study was done to assess the increase in transportation rates which could result.

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4799-4800

c-2 Transportation and Logistics (Cont'd)

TRANSCRIPT
REFERENCE
Vol. XXXIV
4487-4489

- The Judge requested that the logistics and equipment aspects of the evidence be brought to the attention of the Association of Municipalities and the Chamber of Commerce since it has a bearing on phase 4 of the Inquiry.

c-3 Training

Vol. XXXVII
4726-4730

- The crew demands on the expanded barge system as required for the pipeline could be met in one year by promotions of existing crew to the increased number of senior positions, according to Mr. O'Rourke in cross-examination by the N.W.T. Indian Brotherhood.
- The training program for southern workers would be different from that offered to northern workers, according to Mr. Dau.

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4784-4785

c-4 Ordinances

- The hours of work as proposed on the pipeline would be 12 hours per day, seven days a week with the duration of work/holiday periods undecided, according to Mr. Dau. COPE/ITC pointed out that on the basis of the schedule proposed, the hours worked would be in violation of the Labour Ordinance of the N.W.T. and special exemptions would have to be sought.

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4568-4569
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4763-4776

c-5 Strikes

- Strikes were not considered in arriving at the timing and overall costs of the project, according to Mr. Dau, because it was assumed a no strike agreement would be essential to the project. The effect of strikes at suppliers plants and strikes on the Alyeska line were raised by Commission Counsel.

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5171-5174

D. Miscellaneous

- The decrease in government funding to the Native Organizations (CYI, COPE/ITC, Indian Brotherhood/Metis Association) and CARC prompted CARC to call for a two week adjournment of the hearings so they could reassess their financial position. The motion was supported by the Native Organizations and Commission Counsel. The matter was successfully resolved when Treasury Board approved additional funding for the Native Organizations and CARC obtained funds through the Inquiry.

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D. Miscellaneous (Cont'd)TRANSCRIPT
REFERENCE

- The N.W.T. Association of Municipalities advised the Inquiry that their participation would be limited to phase 4 and the informal community hearings.

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4942-4945

E. Inquiry Schedule

The Operations and Maintenance Panel will give evidence from May 16 to May 21 followed by evidence on Arctic Gas's policy (presented by Mr. V. Horte - president). The Operation and Maintenance panel will consist of:

Mr. L. Hurd, Mr. D. Fielder, Mr. M. Carlson

The tentative Inquiry schedule for the summer is as follows:

MAY	- 26, 27	Open	
	28, 29, 30	Hay River	
JUNE	- 2,3,4,5,6,	Yellowknife	
		2-Environment	5-Horte
		3- Protection	6-Horte
		4- Board	
	7,8	No sitting	(Judge to Old Crow)
	9 to 20	No Sitting	(Judge to Alaska)
	23, 24, 25	Ft. Franklin	
	26, 27	Ft. Norman	
	June 30 to		
	July 4	Open	
JULY	- 7, 8	Ft. McPherson	
	9	Arctic Red	
	10, 11	Old Crow	
	14, 15, 16, 17	Yellowknife	- (Formal Hearing)
	18, 19, 20	Wrigley	
	21, 22, 23, 24	Yellowknife	- (Formal Hearing)
	25, 26	Liard and Trout Lake	
	28, 29, 30, 31		
	and Aug. 1	No Sitting	
AUG	- 4, 5	Ft. Good Hope	
	6	Norman Wells	
	7, 8	Colville Lake	
	11, 12, 13, 14, 15	Whitehorse	
	18, 19, 20, 21, 22	Whitehorse	
	25, 26, 27, 28, 29	Tuktoyaktuk and Points North	

Policy and Planning
ACND Division
May 30, 1975

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGSARCTIC GAS CONSTRUCTION PLAN (SUPPLEMENT)

(TRANSCRIPT VOLUME NO. 68)

CANADIAN ARCTIC GAS - CONSTRUCTION
 YELLOWKNIFE, N.W.T.
 SEPTEMBER 24, 1975

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D. MISCELLANEOUS	95

TOPIC: Phase I: Engineering and Construction of the Proposed Pipeline

Panel of Arctic Gas on Construction (recalled)

DATE: September 24, 1975 in Yellowknife

WITNESSES: Arctic Gas' panel consisting of:

- Mr. P.H. Dau: President, Northern Engineering Services Ltd., (NES)
- Mr. G.L. Williams: Director of Field Services Ltd.

HIGHLIGHTS

TRANSCRIPT REFERENCE

A. Technical/Engineering

a-1 Contractors' Productivity Estimates

- In response to Commission Counsel's request for more information that the pipeline contractors had provided to Arctic Gas (see transcript pages 5155 to 5167 and 6652 - 6662). Mr. Dau presented two tables summarizing the information. The seven contractors were contacted by Arctic Gas in 1972. Table one lists their estimates of progress rates, work times and manpower requirements. The second table lists similar information for the current Arctic Gas prime route. Vol. 68
10128-10135
- The tables show that Arctic Gas' estimate of productivity per working day is substantially less than that estimated by the contractors, according to Commission Counsel's cross-examination. Arctic Gas, however, estimates more working days than any contractor. Vol. 68
10136-10143
10146-10147
10179-10182
- The covering letter asking the contractors to concentrate on economics rather than environmental considerations was referring to river crossings, according to Mr. Dau in cross-examination by Commission Counsel. The draft specifications given to the contractors contained environmental considerations. Vol. 68
10143-10146
- The estimates of progress per day are based on the number of welding joints completed per day, according to Mr. Williams in cross-examination by the NWT Brotherhood/Métis Association. Vol. 68
10159-10162
- The estimates are based on the use of 48 inch pipe without crack arrestors, according to Mr. Dau in cross-examination by Foothills. None of the contractors had experience with 48 inch, quarter inch wall pipe when they made the estimates. Vol. 68
10147-10150
10157-10158

<u>a-2 Northern Climatic Experience</u>	<u>TRANSCRIPT REFERENCE</u>
- All the contractors except one have northern winter construction experience, according to Mr. Dau in cross-examination by Commission Counsel.	Vol. 68 10147
- The estimates from the contractors incorporated the use of snow roads and some expressed reservations on their use, according to Mr. Williams in cross-examination by Foothills. There were no reservations about working in the northern darkness using artificial lighting.	Vol. 68 10150-10154 Vol. 68 10154-10157
- The work would start in the fall as soon as weather conditions would permit, according to Mr. Williams in cross-examination by ITC/COPE. CAGPL feels that about 31% of the days would be lost because of weather etc. Darkness and cold would not be a problem to the extent Foothills suggests.	Vol. 68 10162-10170
 B. <u>Environmental</u>	
- nil	
C. <u>Socio-Economic</u>	
- nil	
D. <u>Miscellaneous</u>	
<u>d-1 Cross Delta</u>	
- The cross delta route supplement was provided to the Inquiry participants. Arctic Gas said its witnesses would be prepared to speak to this proposal in January.	Vol. 68 10172-10174

Policy and Planning
ACND Division
October 21, 1975

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT NO. 74)

ARCTIC GAS - CONSTRUCTIONYELLOWKNIFE, N.W.T.
OCTOBER 17, 1975

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TOPIC: Phase I: Engineering and Construction of the Proposed Pipeline

Construction Rebuttal Evidence by Arctic Gas
(in chief only)

DATE: October 17, 1975, in Yellowknife

WITNESS: Arctic Gas' witness:

- G.L. Williams: Director of Field Services, NES.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 Snow Roads

- Referring to evidence on snow roads produced by Dr. Adam (EPB) and Mr. Jarvis (Foothills), Mr. Williams pointed out that there is no one answer to the question of viable snow road construction start up dates. In the Inuvik area where the active layer is thin, the 8 inches of frost required to start can be achieved very quickly. In the Good Hope area more than 8" may be desired. South of Fort Simpson where there are vast areas of muskeg and bog, a substantially longer period would be required - probably in the 1,000 degree-day range if the right-of-way is properly prepared. Mr. Williams went on to point out that Foothills overestimates the number of degree-days required because, as in the Inuvik area, they overestimate the thickness of the active layer. Mr. Jarvis' use of the NRC publication to estimate frost penetration on the basis of degree days is misleading since the article deals with southern peatlands. Mr. Jarvis' experience is also limited to the provinces where the main problem is to achieve a 30" roadbed over peatlands. Use is not made of right-of-way preparatory methods as proposed by CAGPL. In the North, as soon as the small active layer is frozen there is a roadbed hundreds of feet thick. NES's Inuvik work has shown that with right-of-way preparation and after 365 degree days (in October) the active layer was frozen to the permafrost table. This contradicts Mr. Jarvis' views and nowhere in his work does he account for surface preparation in induced frost penetration.
- Previous witnesses agreed that pipeline construction could start as soon as the snow roads are built. The start-up date can also be advanced by using artificial snow, special right-of-way preparation techniques, snow harvesting, etc. Arctic Gas plans to have people and equipment available at all spreads to start snow road construction as soon as possible in the fall. As soon as a few miles of road are built, the construction crews would be moved in. This would be early November near the north end and early December near the Fort Simpson end.

Vol. 74
10971-10993

TRANSCRIPT
REFERENCE

a-1 Snow Roads (Cont'd)

- The right-of-way frost inducement procedures were described by Mr. Williams in response to the Judge's questions. After listing historical start-up dates for various northern projects, Mr. Williams pointed out that these dates support Arctic Gas arguments on the feasibility of early start-up. NES will also monitoring Gulf's snow making activities near Swimming Point.

Vol. 74
11008-11013

a-2 Spread Productivity

- By comparing the Inuvik area spread schedules of Arctic Gas and Foothills, Mr. Williams pointed out that the significant difference between the two plans was in the start-up dates not in the number of miles done by each spread. Arctic Gas plans to start as soon as possible - probably early November, near Inuvik - while Foothills doesn't plan to start until late January. Hence, Arctic Gas would get a three-month jump on Foothills, making their season twice as long as Foothills. This early start-up permits a one month contingency cushion at the end of the season in the event there are problems on the spread.
- A table showing the 'working light' (consisting of daylight and civil twilight) in various northern regions, was presented by Mr. Williams. This showed that Foothills would be faced with problems of darkness even if they followed their proposed schedule. Mr. Williams pointed out that Alaskan experience using artificial lights on construction hasn't affected productivity or the accident rates as Foothills has suggested.

Vol. 74
10993-10998

Vol. 74
10998-11007

B. Environmental

- nil

C. Socio-Economic

- nil

D. Miscellaneous

- Mr. Williams will be cross-examined on the above rebuttal evidence at a future sitting of the Inquiry.

E. Inquiry Schedule

- The schedule for witnesses appearing before the Inquiry for the week of October 20, was outlined by Commission Counsel.

Vol. 74
11013-11024

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUME NO. 86)

YELLOWKNIFE, N.W.T.

NOVEMBER 13, 1975

Note: This summary contains cross-examination only on Arctic Gas's construction rebuttal evidence. See Summary No.44, October 17, 1975 for the evidence in chief.

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TOPIC: Phase 1: Engineering and Construction of the Proposed Pipeline.

Construction Rebuttal Evidence by Arctic Gas
(cross-examination only)

DATE: November 13, 1975 in Yellowknife.

WITNESS: Arctic Gas Witness:

- Mr. G.L. Williams: Director of Field Services, NES

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Engineering/Technical

a-1 Spread Productivity

- The number of working days per spread were determined from meteorological records and on the basis of discussions with people having northern experience, according to Mr. Williams in cross-examination by Foothills. It was a judgement. No chill factors or visibility limits were used to evaluate shutdown time. Arctic Gas' annual schedule shows 136 calendar days with 92 working days, while Foothills' schedule shows 90 calendar days with 67.5 work days. Arctic Gas would start work as soon as physically possible in the fall. Vol. 86
12992-13009
- The working spread would be extended over two to three miles and involves 50 pieces of equipment and five hundred men, according to Mr. Williams in cross-examination by Foothills. It would be artificially lighted during the prolonged winter darkness. Foothills pointed out that a project has never before been attempted under conditions of such cold, darkness with such a "traffic jam" of equipment and men. They questioned the viability of artificially lighting such a project. The Judge pointed out that this was a vital difference of opinion. Mr. Williams agreed that no unions had been contacted to find out if they would permit their people to work under such conditions. Mr. Williams said that the key to meeting the schedule was to start as soon as possible in the fall and work as many days as possible. Vol. 86
13013-13036
- The scheduling for the northernmost spread and the spread near Fort Simpson would be difficult to meet because of the need to wait for freeze-up conditions to make river crossings and snow roads according to Foothills in cross-examination of Mr. Williams. Vol. 86
13009-13013
13036-13047
- The spread productivity was determined by Arctic Gas management and engineers, and contractors had to devise a means of achieving it, according to Foothills in cross-examination of Arctic Gas. Mr. Williams said that was not correct. Vol. 86
13047-13048

a-1 Spread Productivity (cont...)TRANSCRIPT
REFERENCE

- The work to be done by Arctic Gas and Foothills in the northernmost spread in the time frame proposed by each puts both companies in about the same position, according to Commission Counsel in cross-examination of Mr. Williams. Arctic Gas would do 74 miles over 5½ months while Foothills would do 60 miles over 3 months. Vol. 86
13049-13057
- The Judge remarked that the problems pointed out in Foothills' cross-examination of Mr. Williams appear to apply equally to both applicants. The feasibility of either schedule is questionable. Vol. 86
13055-13058

Policy and Planning
(ACND) Division.
December 10, 1975.

MACKENZIE VALLEY PIPELINE INQUIRY

SUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES 40 TO 42)

OPERATION AND MAINTENANCE

YELLOWKNIFE, N.W.T.

MAY 16-21, 1975

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TOPIC: Phase 1; Engineering and Construction of Proposed Pipeline.

Panel on: Operation and Maintenance (O&M)

DATE: May 16 to 21 in Yellowknife

WITNESSES: Panel on Operation and Maintenance

- L.G. Hurd: Director, Planning and Special Studies,
Canadian Arctic Gas.
- M.E. Carlson: Director, Operation and Maintenance, Canadian
Arctic Gas.
- D.E. Fielder: Manager, Operation and Maintenance, Canadian
Arctic Gas.

HIGHLIGHTS

TRANSCRIPT REFERENCE

A. Technical/Engineering

a-1 General

- Section 13b of the application as filed (exhibit #55) Vol. 40
outlines the principles of operations and maintenance 5204-5206
(O&M) planning but this will be subject to modifica-
tion as more detailed designs are established,
according to evidence led by Mr. Hurd. The compressor
stations would be remote controlled from a gas control
center in Calgary.
- The organization of the operation and maintenance Vol. 40
(O&M) program will be by divisions and districts with 5206-5208
the men and equipment assigned to each co-ordinated
with Alaska Arctic Gas from the control center
according to Mr. Hurd. The organization charts and
personnel tables contained in the application were Vol. 40
presented by Mr. Fielder. 5221-5222
- The preparation of the O&M procedure was supervised
by Mr. Hurd with the support of a committee of 20 to Vol. 41
30 others according to cross-examination by Foothills. 5286-5288
Alberta Gas Trunklines contributed more than any
other participant in Arctic Gas because of their
experience in harsh northern climates. There are
now only two people full-time on the operations and
maintenance (O&M) work backed by consultants and Vol. 42
assistance from the participating companies in 5285-5286
Arctic Gas.
- The post construction start up plan was outlined Vol. 40
by Mr. Hurd. This includes: (1) system calibration, 5224-5225
(2) purging with natural gas, (3) station (compres-
sors and chillers) start up.

a-2 Contingency Planning

- Equipment for repair of the system would be avail- Vol. 41
able from staging areas along the route, according 5294-5297
to the Foothills cross-examination. For example,
one spare gas generation would be available at
the divisional supply source for each 4-6 compres-
sor units in service. This spare unit could be
moved to the station by a helicopter or, in the case
of an industrial type turbine, by a low ground
pressure (LGP) vehicle.

a-2 Contingency Planning (Cont'd)TRANSCRIPT
REFERENCE

- The pipeline rupture frequency statistics presented in response to the PAAG question #22 were questioned by the Environmental Protection Board (EPB) and the Judge. The statistics show a rupture frequency of one break in 9.5 years of which half are caused by external forces such as construction equipment damaging the line. The figures are based on U.S. and Canadian records of pipelines after the initial break-in periods. The EPB pointed out that there is some argument about the break-in period which was assumed to be 2 years. The inclusion of this period would give higher frequencies. Although the construction and operating conditions for this pipeline are unique making statistical performance projections somewhat misleading, the panel pointed out that the beneficial aspects of the environment such as decreased corrosion and activity adjacent to the pipeline make the figures quoted conservative. Vol. 40
5245-5253
- The contingency planning for a major break in the pipeline would involve the preparation of standing orders for each section of the line according to Mr. Hurd. The pipeline profile, soils, availability of roads, etc., would be taken into account as well as the capabilities of local contractors. A list of the governmental bodies to be notified would be included. The pipeline break would be detected by station data initiating an automatic shutdown. Staff would be dispatched to the break location and government and customers would be notified. Equipment would then be sent to the site in the order it is required, the block valves would be closed and the blow down valves opened. Two 12 hour shifts would be used until the repair had been completed. Then, equipment and unused material would be returned to the staging areas and revegetation would be undertaken as required. Vol. 41
5238-5244
- Each contingency plan is a study in itself according to Mr. Hurd in cross-examination by CARC. Detailed plans will be developed after regulatory approvals and final design for each area (between compressor stations) depending on physical features, facilities, special environmental considerations by season, etc. In the example given of a break on the Prudhoe Bay lateral at MP290 at the time when snow geese are staging for their flight south, (August 15 to October 1) aircraft would be used to locate the break. Details of access and repair procedures would be done in conjunction with government land use officials. Vol. 41
5350-5354
- River crossing failure contingency plans were discussed by Mr. Hurd in chief. Where dual crossing existed, the flow would be switched to the undamaged line. For single pipe crossings such as the Bear River, a temporary small diameter pipe would be installed until the repair could be made. Vol. 40
5253-5258
- The Shallow Bay line would be designed as a dual crossing because of the difficulty of making repairs, according to Mr. Hurd in cross-examination by COPE/ITC. Inspection of this line would be difficult because of the silty water. Contingency plans for the offshore right-of-way would probably be similar to those for Shallow Bay but that route has not been subject of study. Vol. 42
5417-5421

a-3 Compressor StationsTRANSCRIPT
REFERENCE

- The compressor stations will be capable of remote operation but will have a staff of two for the break-in period, according to Mr. Hurd in cross-examination by COPE/ITC. It was pointed out in cross-examination that although the Trans-Canada system was designed for remote operation, the stations are manned. Mr. Carlson stated that this is being reviewed and will probably result in unmanned operations. Vol. 42
5393-5395
- The measurement facilities maintenance plan, according to Mr. Hurd, will involve routine inspection of: (1) the meter stations and meters at compressor stations, (2) the waste disposal effluent and sludge incineration, and (3) the water treatment process. Vol. 40
5236-5237
- The aircraft type and industrial type turbines are being considered for the stations according to cross-examination by Foothills. The industrial type is less conducive to modular repair and has a longer life between overhauls than the aircraft type. The final decision on the type of turbine will be made after regulatory approvals. Vol. 41
5288-5293
- Unscheduled major station repairs would be detected by alarms on site and at the control center according to Mr. Hurd. Critical parts will be available from divisional stores and detailed contingency plans will be developed for each station. These will include special procedures for fire, etc. Vol. 40
5258-5259
Vol. 42
5403-5404

a-4 Safety

- All compressor stations will be fenced and may be equipped with alarms, according to Mr. Hurd in cross-examination by Commission Counsel. Entrances will remain locked and warning signs will be posted. Vol. 42
5497-5500
- Safety training will be given on northern survival and field crews will be supplied with automatic radio location equipment, according to Mr. Hurd. Vol. 40
5220

a-5 Fire

- Fire at compressor stations and on the right-of-way was discussed by Mr. Hurd. Each compressor station would be equipped with a fail-safe detection system which would automatically shut down the station in the event of a fire, isolate it from the pipeline and displace oxygen inside the station with an inert gas. In order to prevent soil instability on the right-of-way, restoration procedures would be initiated as soon as possible after a fire. If damage was severe in a permanent area, temporary restoration using insulated blankets or straw would be used until permanent revegetation could be undertaken. Vol. 40
5259-5262

a-6 Monitoring

- Monitoring of the pipeline can be broken into three main parts as detailed in the response to PAAG question #55, according to Mr. Hurd. These are: (1) normal line patrol monitoring using aircraft or people on foot, (2) critical area monitoring using instruments such as on slopes, flow velocity at culverts, etc., and Vol. 40
5232-5236

a-6 Monitoring (Cont'd)TRANSCRIPT
REFERENCE

- (3) detailed monitoring in sensitive areas such as at Chick Lake where vegetation, fish, mammals, birds, etc., are subject to intense scrutiny.
- The monitoring of frost heave and other potential geotechnical problems was questioned by Commission Counsel in cross-examination of Mr. Hurd. The trench soil data log prepared during ditching would be maintained at the district headquarters and would be used in assessing heave in previously identified heave problem areas where rods would have been installed on the pipe at 100 to 300 foot intervals. Ground thermal regime monitors would be required on some slopes and would be read during periodic site visits. These visits would have to be every month or so during the first season of operation. The appropriate remedial measures would be decided by the district manager and headquarters with consultant advice as required. Vol. 42
5483-5493
 - Routine monitoring would include, according to Mr. Hurd, erosion, cathodic protection, preventative maintenance predictive schedules, operations parameters, safety procedures, etc. Vol. 40
5225-5228
 - Fixed wing aircraft would be the standard method of line patrol, according to Mr. Hurd, but this would be supplemented by helicopters, all terrain vehicles (ATV) and ground patrols if required. Ground patrol personnel would be specially trained to look for erosion and gas leak evidence, perform routine tasks such as valve assembly maintenance. Vol. 41
5308-5311
Vol. 42
5395-5398

a-7 Equipment

- The general breakdown of equipment required for the operation and maintenance of the project was given by Mr. Hurd. It was divided into conventional equipment for use where there were all weather roads and special equipment such as low ground pressure (LGP) vehicles for use where access is difficult. Much of this equipment will be surplus from construction and will be overhauled and used for on-going operation and maintenance. Vol. 40
5210-5211
- Illustrations of low ground pressure (LGP) vehicles, air cushion vehicles (ACV) and special purpose equipment such as terrain protection mats and pontoon sets were given by Mr. Fielder. Air cushion vehicles and the special equipment would be based in Inuvik. All equipment that was illustrated are commercially available. Vol. 40
5262-5272
- The terrain capability of the ACV's is such that the height of the surcharge berm (5 foot maximum) may make it necessary to use other means of access according to cross-examination by COPE/ITC. The noise of ACV's is the subject of a working group of an NRC associate committee on ACV technology. Air cushion assist on other vehicles such as trucks can reduce their load effect by half. Vol. 40
5211-5214
- The type of ACV to be located in Inuvik has not been finalized, according to Mr. Fielder in cross-examination by Poothills. It could be Vol. 41
5389-5390
Vol. 42
5413-5417
- The type of ACV to be located in Inuvik has not been finalized, according to Mr. Fielder in cross-examination by Poothills. It could be Vol. 41
5299-5308

a-7 Equipment (Cont'd)TRANSCRIPT
REFERENCE

- a 24 ton self-propelled vehicle or a 100 ton non self-propelled vehicle. The latter vehicle would be of limited usage at break-up and freeze-up when the towing vehicle would have difficulty crossing water. The 100 ton vehicle can negotiate obstacles up to 6 feet high while the 24 ton is limited to 3 foot obstacles and 8 degree slopes. Where these limits are exceeded, the use of ACV's would be very difficult if not impossible and rolligons might be used instead.
- The allocation of equipment to various parts of the pipeline, as described in the application, appears to be random according to Commission Counsel in cross-examination. Mr. Hurd stated that the deployment is tentative and depends on access to an area. If the Mackenzie Highway is not completed to Fort Good Hope as assumed in the application, changes will be made.

Vol. 42
5520-5527

a-8 Aircraft

- The five types of aircraft to be used in the operation and maintenance of the pipeline were described by Mr. Hurd. They are: (1) type A, a fixed wing STOL aircraft with a cargo capacity of 4,000 lbs., (2) type B, a three passenger fixed wing aircraft for use in line patrol, (3) type C, a large fixed wing aircraft with a capacity of 45,000 lbs., (Herc.) to be chartered as required, (4) type D, a 1,200 lb. sling load capacity helicopter to be owned by the applicant, (5) type E, a cargo helicopter with an 8,000 lb. capacity to be owned by the applicant in Inuvik and leased in Norman Wells and Fort Simpson. All aircraft will be IFR equipped as will be the airstrips. Hangar space will be leased or built by the applicant.
- The gravel required for airstrip maintenance represents a very small part of the total project borrow requirements and therefore has not been isolated as a specific item in the borrow calculations, according to Mr. Hurd in cross-examination by Foothills.

Vol. 40
5214-5216

Vol. 41
5293-5294

Vol. 40
5217-5218

Vol. 41
5297-5299

a-9 Soviet Experience

- The Soviet experience in northern natural gas pipelines was outlined by Mr. Fielder who had visited the U.S.S.R. as part of group sponsored by the Department of Industry, Trade and Commerce in 1974. It was his opinion that not much is to be learned from the Soviet technology since most of their pipelines are in areas of little or no permafrost. They use both buried and bermed construction techniques located primarily in river flood plains which are sandy and well drained. He was told that many of the bermed areas had to be rebuilt annually. The Russians had not used test sites prior to constructing their facilities but they now realize such testing is beneficial and are therefore planning sites.
- A map showing the location of the three gas pipelines in the Arctic regions of the U.S.S.R. was distributed and described by Mr. Fielder in response to the Judge's request for further information. The fields described were: (1) the

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a-9 Soviet Experience (Cont'd)TRANSCRIPT
REFERENCE

- Taas-Tumus Yakutsk-Pokroust Line (Eastern Siberia), (2) the Messoyakha-Nordsk Line and, (3) the "Northern Lights System" in northwest Siberia serving the Medvezhye gas field. The Yakutsk System (1) is 221 miles long of which 120 miles is above ground. It was begun in 1964 and consists of 10 and 20 inch pipe. The Messoyakha-Nordsk System (2) is 265 km. long and is located entirely north of the Arctic Circle. It was looped in the winters 1971 to 1973 with the second line located 500m. to 4km. away from the first. There are 4 major and 80 minor river crossings. The crossing of the Yenesei River involves six 40cm. lines. The two 28-inch lines are 1m. or more above the ground surface. The Medvezhye to Punga System (3) is of 48 and 56-inch pipe from the huge Medvezhye reserves (14 trillion cubic meters) to Pungo 415 miles away. It is in an area similar, for construction purposes, to northern Alberta and has a buried dual river crossing consisting of a 56-inch and 42-inch (backup) pipes. The compressor stations on this system are spaced at approximately 80 mile intervals. They have an inlet pressure of 810 lbs. per square inch and an outlet of 1,100 lbs. per square inch moving 18 million cubic meters of gas per day.
- The extent of Soviet experience in the above projects was pursued with Mr. Fielder by the Judge. Mr. Fielder did not know what was done on the parts of the Yakutsk line (1) that wasn't pile supported. The Messoyakha-Nordsk line (2) near the Ob River was in permafrost. The report by Taylor stated that the environmental effects of this line were minimal. Mr. Fielder explained that the main concern was not to interfere with the caribou. This was done by raising the line to 2 meters above the ground or by burying it, at selected locations. The Medvezhye system (3) was on well drained frozen sand where it crossed permafrost areas. In general, Mr. Fielder concluded that more could be learned from Alaskan experience with the hot oil pipeline than could be learned from the Soviet experience. Russian construction in an Arctic environment and logistics via a river supply system (Ob) would be helpful. Mr. Fielder was not aware of what considerations the Soviet engineers gave to the chilled gas concept but suggested that they probably took the most economic course in not chilling the gas considering their permafrost conditions and the significant cost of chilling. Three reports (one a draft) on the Industry Trade and Commerce group visits to the Soviet Union were filed. (exhibits 124, 125, 126)
 - The proven reserves of five gas fields in the Medvezhye area of the Soviet Union were given by Mr. Fielder as follows: (1) Urengoy 4 trillion cubic meters (TCM), (2) Zapolyarnoye 1.5 TCM, (3) Artichascoga 1.5 TCM, (4) Ingubinskaya 2 TCM and, (5) Medvezhye 1.5 TCM. The general Medvezhye area is reported to have proven reserves of 14 TCM but geologists feel that 22 TCM is closer to correct. By comparison, Prudhoe Bay has less than 0.8 TCM. In the Soviet Union every aspect of gas development is controlled under one authority.

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a-9 Soviet Experience (Cont'd)TRANSCRIPT
REFERENCE

- The Russians drill test holes every 25m along the pipeline but it is not clear to what extent they use non-destructive analysis (geophysical) techniques, according to Mr. Fielder in cross-examination by Commission Counsel. Their experience with buried gas pipelines is limited and none of their systems convey gas chilled to below 0° c. Their use of six pipes to cross a river rather than only two was probably because of the ease of installing the smaller diameter pipes, according to Mr. Fielder. He went on to suggest that their ice jam experience was probably limited by the non-jam forming characteristics of their rivers.

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5422-5431

a-10 Miscellaneous

- The El Paso solution to frost bulb interference with subsurface drainage at river crossings in Alaska is to encase the pipe in 6 inches of concrete and thereby insulate the pipe, according to information provided by Foothills.
- A report by Kerfoot of EMR entitled, "Mackenzie Delta - A Summary Report of Surface Conditions" was filed with the enquiry by Commission Counsel for reference in assessing the Cross Delta Proposal.

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B. Environmentalb-1 Pipeline Failures

- Pipeline failures can be divided into: (1) minor failures permitting postponement of repair and, (2) major failures requiring immediate attention, according to Mr. Hurd in cross-examination by Commission Counsel. It is corporate policy of Arctic Gas to consult environmentalists prior to undertaking a major repair. In the example of a break at the Donnelly River as cited by Commission Counsel, Mr. Hurd confirmed that environmental advice would be obtained, and if the break occurred during critical greyling times, a temporary line could be placed across the river.
- The operation and maintenance (O&M) manual would provide contingency plans for specific areas and will include seasonal access information, according to cross-examination of Mr. Hurd by Commission Counsel. Stockpile sites will be strategically located to permit repairs without causing major environmental damage. The detailed plans are not yet done.

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b-2 Frost Heave and PermafrostTRANSCRIPT
REFERENCE

- The building of a surcharge berm to control frost heave on the pipeline would be done in winter using LGP vehicles, according to Mr. Hurd in cross-examination by Commission Counsel. Most of these problems would occur in the discontinuous permafrost area where the pipeline would be near the river or the assumed Mackenzie Highway. Frost heave occurs slowly and would be detected and remedies applied. The EPB express concern over the possible terrain damage caused by equipment undertaking such a repair. Vol. 42
5480-5482
- Monitoring of the permafrost along the right-of-way would be done as part of the O&M phase according to cross-examination of Mr. Hurd. Vol. 41
5319-5320
- Monitoring of the permafrost along the right-of-way would be done as part of the O&M phase according to cross-examination of Mr. Hurd. Vol. 42
5495-5497

b-3 Right-of-Way Vegetation and Maintenance

- The thermal balance restoration would take more than 10 years if the surface peat cover was disturbed according to the EPB in cross-examination. They cited the example of bulldozer disturbance of surface vegetation at Prudhoe Bay resulting in 6 foot deep scars over a 5 or 6 year period. The EPB suggested that the applicant's impact considerations did not account for the value of land left in its natural state. Vol. 41
5320-5325
- The right-of-way, borrow pits and haul roads would be seeded the spring after construction, according to Mr. Hurd, and would be checked as part of the line patrol duties. Vol. 40
5229-5232
- Patrol and maintenance of the right-of-way after abandonment of the pipeline have not been considered, according to Mr. Hurd in cross-examination by Commission Counsel. Vol. 42
5494-5495
- The seasonal timing of nine types of maintenance on drainage and vegetation aspects of the project were given by Mr. Hurd in response to questions by Commission Counsel. The environmental concerns, urgency and trade-offs for each would be incorporated into the O&M manual. Vol. 42
5472-5480

b-4 Fire

- The detailed contingency plans for fire on the pipeline right-of-way are not yet prepared, according to Mr. Hurd in cross-examination by ITC/COPE. Pipeline related equipment will be available to fight fires unless it is essential to the safe operation of the pipeline. Vol. 42
5398-5403
- Fire damage caused by the pipeline company will be repaired and damage from other causes will be attended to where it affects the right-of-way according to Mr. Hurd in cross-examination by ITC/COPE. Protective blankets or straw would be used on the right-of-way. Vol. 42
5404-5408
- Protective blankets would be used over hundreds of square yards in critical erosion areas such as slopes, according to Commission Counsel's cross-examination of Mr. Hurd. Fire breaks would be cleared around compressor stations. Vol. 42
5468-5472

b-5 Compressor Stations

- The start-up of compressor stations would involve more than one flight to the site per day by a small aircraft or helicopter and some noise Vol. 42
5431-5437

b-5 Compressor Stations (Cont'd)TRANSCRIPT
REFERENCE

associated with blow-off air and blow-down of the station piping, according to cross-examination of Mr. Hurd by Commission Counsel. Environmental advice would be considered and people in the adjacent communities (if affected) would be consulted when deciding when to conduct the start-up operation. Blow-down of a high pressure line can be alarming and, apart from emergencies, can be deferred to suit environmental advice.

- Synthetic lubricants and cooling fluids used at compressor stations will be stored in steel tanks and spill procedures for these substances have been discussed, according to Mr. Carlson in cross-examination by CARC. The toxic qualities of these substances, particularly Imol S-140 lubricant, was emphasized. Trans-Canada pipeline uses synthetic lubricants exclusively.

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5335-5337

b-6 Aircraft Flights

- During operation of the pipeline, an aerial line patrol would be conducted once a month except during critical times such as the spring when the frequency could be once a week or more, according to cross-examination of Mr. Hurd by Commission Counsel. Visits to compressor stations would be 1 to 3 times per week. All flights would be supervised by Arctic Gas who would specify the height and route of the flight. Policing of the flights would be by contractual arrangement and by Arctic Gas personnel on almost all flights. Commission Counsel requested a list of the number of flights of different types of aircraft at a typical construction spread during peak construction.

Vol. 42
5438-5443

- Line patrol flights would inspect the right-of-way plus ancillary facilities such as roads, borrow pits, etc., according to Mr. Hurd in cross-examination by Commission Counsel. The ideal flight height would be 100 to 150 feet although greater heights (500 to 1,000 feet) would be considered to minimize environmental problems. The aircraft dispatcher and operators would be trained in environmental matters and would receive advice from the environmental staff at division headquarters who would be in touch with the staff of the Canadian Wildlife Service and Territorial Government. Commission Counsel asked for a list of the applicants staffing planned for this work. The operation and maintenance manual would also have stipulations. Competing environmental concerns would be dealt with by experts on staff in Calgary. Line patrol flights could be interrupted for 3-4 months in the winter if necessary. Spring and summer flight interruption periods would depend on the rains, state of revegetation, etc.
- The disruption of snow geese by aircraft along the north coast was the reason that the Biological Report Series document suggested that flights be curtailed between August 15 and September 30 according to CARC in cross-examination of Messrs. Fielder and Hurd. Mr. Fielder suggested that many people make recommendations and no one could be considered in isolation. When CARC pointed out that Alaskan Arctic Gas documents

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b-6 Aircraft Flights (Cont'd)TRANSCRIPT
REFERENCE

- stated that flights in the goose area would be curtailed or kept to a minimum altitude of 1,000 feet, the panel conceded that the same stipulation would apply on the Canadian portion subject to the same environmental concern.
- Overflight restrictions for environmental reasons would be cleared with MOT, DEW line operations and military officials, according to Mr. Hurd in cross-examination by COPE/ITC. Vol. 41
5368-5372
 - Float planes would not be used on north slope lakes, according to Mr. Hurd in cross-examination by Commission Counsel. Vol. 42
5451-5453

b-7 Surveillance and Constraints

- The O&M procedures manual will be prepared after regulatory approvals and final design and will include a section on environmental protection measures, according to Mr. Hurd in cross-examination by CARC. Vol. 41
5332-5335
- The application of environmental constraints in the Alaskan Arctic Gas application to similar situations in the Canadian environment was pursued by CARC (see b-6 above) and Commission Counsel. Counsel for Arctic Gas agreed to investigate the appropriate constraints in the U.S. Application to see if they could be accepted in the Canadian portion as well. Vol. 41
5365-5368
- Environmental surveillance by the relevant government agencies has not been specifically accounted for in contingency plans, according to Mr. Hurd in cross-examination by CARC. After a line break a complete report would be prepared for Arctic Gas management and the government agencies concerned such as the National Energy Board. CARC questioned the public availability of such reports and the Judge suggested that such availability could be argued by CARC as one of the terms and conditions to the granting of the right-of-way. Mr. Hurd indicated that no formal consideration had been given to the possibility of involving an independant environmental council as CARC suggested was being done in Alaska - the Arctic-Environmental Council under the Arctic Institute of North America. Vol. 41
5325-5330

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5330-5332

b-8 Miscellaneous

- Regular tests of sewage effluent would be conducted to assure compliance with government standards. Vol. 41
5364-5365
- Equipment such as rolligons and ACV's would be operated in accordance with manufacturers specifications and stipulations in the O&M manual, to minimize terrain damage, according to Mr. Fielder in cross-examination by Commission Counsel. Vol. 42
5500-5507

C. Socio-EconomicTRANSCRIPT
REFERENCEc-1 Employment of Northerners

- The anticipated O&M personnel requirements for the Northern and Southern Division were described by Mr. Fielder. Northern residents will be hired to greatest extent possible with many of the people hired from the construction phase of the project. Housing will be provided or ownership assistance will be given to permanent employees who will be based at divisional headquarters. Temporary jobs will be provided to people from the communities and these part-time workers could qualify for full-time employment through the on-going training programs. Vol. 40
5208-5210
5223
- The existing industry wide northerer training program for on the job training in all aspects of the gas and oil related industry was described by Mr. Hurd in cross-examination by COPE/ITC. The program was said to be unique in that it provided training in a wide field including pipeline operations and maintenance, seismic work, process plant operations, administrative work, equipment operation, welding, etc. The object is to have employees with more than one skill so they could perform emergency work if necessary. The training period is governed by the individual and varies from a few months to many years. Training is carried out in the north as much as possible but since there are few operating facilities located there, most job experience is now gained in the south. The number of Indian and Métis employees on the Trans-Canada Pipeline System (a member of the Arctic Gas Consortium) and the union recognition of training programs were not immediately known to the panel. Further investigation by the panel revealed that there were 3 natives out of a total work force of 254 on the central Trans-Canada Pipeline System (west of Kenora to Kapuskasing). Mr. Hurd's information indicated that one trainee, who is a ticketed welder, was doing inspection work for Trans-Canada. To this point there have been no trainees as union members but discussions with unions and the contractors associations have taken place. Vol. 42
5387-5389
- Vol. 41
5372-5384
- Vol. 42
5385-5387

c-2 Local Business

- Local businesses will be used where possible in the operations and maintenance phase to maintain roads and airstrips and to supply parts, according to Mr. Hurd. Vol. 40
5218-5232
- Aircraft availability for lease and charter work is under study, according to Mr. Hurd in cross-examination by COPE/ITC, but it is too early to be approaching companies yet. Vol. 42
5390-5393

D. Miscellaneousd-1 RoutingTRANSCRIPT
REFERENCE

- The Judge ruled (on a motion by CARC) that evidence relating to the alternative routes and corridors would be heard at the end of phase 1 and would be heard in Whitehorse in August. The routes mentioned were: (1) the prime and alternate routes as filed by Arctic Gas, (2) the Offshore route, (3) the Fairbanks route, (4) the Fort Yukon route and (5) the edge of shield route.

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5444-5451

E. Inquiry Schedule

Mr. Horte, president of Arctic Gas, will give evidence May 21st to 24th, June 5th and 6th and when formal hearings resume in Yellowknife in July (see below). The Environmental Protection Board will give evidence in chief only (no cross-examination) June 2nd, 3rd and 4th.

The revised (May 31, 1975) tentative Inquiry Schedule for the summer is as follows:

JUNE - 9 to 14	Judge to Alaska	
16 to 20	no sitting	
23, 24, 25	Ft. Franklin	
26, 27	Ft. Norman	
June 30 to		
July 4	no sitting	
* JULY - 7, 8 and 9	Ft. McPherson	
* 10, 11	Old Crow	
* 14, 15	Wrigley	
* 16, 17	Ft. Liard	
* 18 to 26	Yellowknife	
28 to Aug 1	no sitting	
AUG - 4, 5	Ft. Good Hope	
6	Norman Wells	
7, 8	Colville Lake	
* 12 to end		
of August	Whitehorse	(routing and corridor evidence)
* Revisions		

Policy and Planning
ACND Division
June 11, 1975

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES 42, 43, 44, 45, 49, 50, 56)
MAY 21 TO 24, JUNE 5 & 6 AND AUGUST 18, 1975

ARCTIC GAS POLICY

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TOPIC: Phase I: Engineering and Construction of the Proposed Pipeline.

Panel on: Arctic Gas Policy.

DATE: May 21 to 24, June 5 & 6 and August 18, 1975.

WITNESS:

- Mr. V.L. Horte: President, Canadian Arctic Gas Pipeline Limited

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 Company Organization

- The formation of Canadian Arctic Gas Study Limited and Alaska Arctic Gas Study Ltd. was described by Mr. Horte. The company policy is decided by three groups within a Management Committee: (1) Canadian non-producing companies, (2) U.S. non-producing companies and (3) Alaskan and Canadian Producers. The companies that have withdrawn from the organization were listed. Technical, Environmental, Financial, Legal and Public Affairs Committees are formed within the Company. Mr. Horte presented and described an organizational chart of the company noting that when construction commences it will be superseded by a conventional organization controlled by a board of directors. CARC asked for clarification of this in cross-examination. Vol. 42
5532-5543
Vol. 44
5826-5828
- The interaction of specialists, consultants and management within Arctic Gas was described by Mr. Horte. Northern Engineering Services (NES) acts as principal consultant on location, design, geotechnical, construction and environmental aspects. They in turn hire sub-consultants. Arctic Gas and their consultants handled areas of the gas supply, operation and maintenance, Northerner Training Program, and regional socio-economic impact. More recently Northcan Engineering and Management Ltd. was retained to detail work involved in implementation of the construction plan in areas such as: (1) labour requirements, availability, training and agreements, (2) equipment procurement, (3) contractor capability and contract agreements, (4) logistics, (5) cost and other control mechanisms. Vol. 49
6508-6510
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5535
Vol. 43
5584-5587
- The nationality of the sponsor companies in Arctic Gas and the veto aspects of management voting were questioned by Foothills. It was suggested that the decision-making processes at Arctic Gas are influenced by (1) equity ownership in the pipeline company and, (2) membership of sponsor companies in other groups connected to the project. The rights of all participants to the information obtained while they were members of the consortium were confirmed by Mr. Horte. Recent withdrawals from Arctic Gas were Canadian Utilities Ltd., Neumac Oil and Gas and Sunoco. Vol. 43
5593-5604

<u>a-2 Project Review, Control and Surveillance</u>	<u>TRANSCRIPT REFERENCE</u>
<p>- Northcan was retained by Arctic Gas only for support studies to the NES plan, according to Commission Counsel's cross-examination. The participants in Northcan were given by Mr. Horte. The construction and engineering management of the project has not been finalized but Arctic Gas will closely control every aspect throughout. The traditional southern "turn-key" approach would be unsuitable in view of Arctic Gas's special environmental and socio-economic responsibilities. Control will always rest with Arctic Gas who will seek support from NES. A senior Arctic Gas employee will be on each spread to resolve competing interests. Problems that cannot be resolved in the field will be referred to the head office of Arctic Gas. Contracts will be such that decisions will be binding on the contractor. No independent design review process is envisaged, desirable or necessary in view of the capability of NES and the review process of the Inquiry and the NEB. Mr. Horte explained that the project would also be reviewed in detail by investors who would place capital in the project. They often get second opinions. Obtaining the money illustrates confidence. If the regulatory approvals were forthcoming in the first quarter of 1976, the project could go immediately to financing. This project has gone further in its pre-approval stage than would be required for a southern project.</p>	<p>Vol. 50 6704-6726</p> <p>Vol. 44 5775-5778</p>
<p>- Detailed contingency plans for events such as breaks are worked out beforehand with the regulatory body, according to CARC's cross-examination. When a break occurs, the regulatory body is immediately notified of the repair plans and simultaneously action is taken to effect the repair. A regulatory representative is usually on site and after the work is done, the company reports on the cause, repair procedure, etc. The contingency plans submitted to the regulatory body are a matter of public record. The present contingency plans are subjected to public review and there would be no need for a second review after regulatory approval. At that stage the construction regulatory agency would be the vehicle for public and Native input.</p>	<p>Vol. 49 6610-6614</p> <p>Vol. 50 6632-6635</p>
<p>- The National Energy Board would be the logical single agency to oversee construction since they have the experience and their Act provides for such responsibility, according to Mr. Horte in response to ITC/COPE and the Judge's questions. Other interests could probably be incorporated into that group. Financing of the project would depend on having one authority. Arctic Gas has not suggested this to the government although their preference is to have the NEB.</p>	<p>Vol. 45 5932-5937 5946-5948</p>
<p>- Financing of the project could not be arranged if the regulatory authority for construction and operation of the pipeline was not spelled out in the Government permit. The National Energy Board (NEB) has the regulatory expertise now although they would have to add staff for a project of this</p>	<p>Vol. 49 6599-6608</p>

TRANSCRIPT
REFERENCEa-2 Project Review, Control and Surveillance
(Cont'd.)

magnitude, according to Mr. Horte in cross-examination by CARC. The NEB is the logical agency. It would be preferable to have the same single agency for north of 60 and south of 60. The agency must have a clear line of accountability to or through the Government of Canada.

- The construction plan is based on regulatory approvals in the first quarter of 1976 according to Mr. Horte. Approval time and construction lead time are greater than originally anticipated. This delay may require a one year shift in the construction schedule. A pre-approval commitment on certain logistical items such as barges and boats could be made if the progress at hearings was deemed favourable. However, the terms and conditions would have to be known before final design was started. The Judge pointed out that Alyeska is already one year behind schedule and questioned the urgency of getting the Alaskan gas out as the oil is produced. Mr. Horte indicated that the Alaskan gas could be reinjected and the urgency was related more to the long term costs of reinjection and the urgency of getting gas to market.
 - Vol. 45
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 - 5993-5994
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 - 7804-7808
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 - 7873-7878
- The Native and public concerns would be better represented through the government agency than through membership on the Arctic Gas environmental committee since that is the nature of government, according to cross-examination by CARC. Their terms and conditions must be clear before the project starts. Arctic Gas has clearly presented its intentions and the Inquiry and the NEB can bring forward alternatives.
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 - 6623-6632

a-3 Construction Contracts and Management

- Northcan's assignment is to detail the construction plan so that once certification is received the project can move ahead quickly, according to the EPB's cross-examination. Control will always rest with Arctic Gas and Arctic Gas will make sure that the promises made at the Inquiry are carried out.
 - Vol. 44
 - 5731-5736
- Northcan's role will not necessarily extend into the construction phase according to cross-examination of Mr. Horte by CARC. If they are involved in construction it will be under Arctic Gas's supervision. The construction must operate within the design recommendations of NES. Northcan has no environmental consultants and is controlled by Arctic Gas. It is expected that the previous environmental consultants will also be used during construction. Only Arctic Gas can change the construction plan based on advice from NES and Northcan.
 - Vol. 49
 - 6510-6518
- The type and terms of construction contracts are being examined by Northcan, according to cross-examination by Commission Counsel and CARC. There will not be a "turn-key" contract. The present tendency is toward a cost plus target price contract with incentives. The Alyeska
 - Vol. 50
 - 6636-6637
 - 6726-6740
 - Vol. 56
 - 7851-7852

a-3 Construction Contracts and Management (Cont'd.)TRANSCRIPT
REFERENCE

contracts are cost plus percentage fee. No studies have been done to see if this type of contract has produced the desired results. A cost plus some form of fee is necessary because of (1) project novelty and, (2) uncertainty of outside controls. The advantages and disadvantages of Arctic Gas purchasing construction equipment are being investigated. Arctic Gas's policy is to maximize the use of Canadian contractors, materials and personnel. The project will benefit the lagging pipeline industry but should not overstress it. Contractors will be selected on the basis of bids, experience and demonstrated capability. Arctic Gas will make the final decision with input from NES and Northcan. The contractors may have to add staff to handle northern environmental problems. Performance will be assured by contractual arrangements.

a-4 Project Financing

- Funding for detailed design work would not be available until after U.S. and Canadian regulatory approvals and financial commitments are made, according to Mr. Horte in cross-examination by Commission Counsel. Arctic Gas's funding is sufficient for the study and regulatory phase. When approvals are received, Arctic Gas hopes to get a substantial conditional commitment from Canadians. If Canadians obtain 60% of the equity they will form a majority. Effective control could be by the largest shareholder even if that was less than 50% of the shares. Vol. 45
5966-5969
- No decision has been reached on equity allocation according to Mr. Horte. Foothills pointed to the F.P.C. evidence by Mr. Bracket of Arctic Gas stating that equity allocation would be on the basis of throughput. Mr. Horte explained that the objective is to get maximum Canadian participation, which he believed would be greater than 50% (which is 700 million), with the remainder sought elsewhere. TransCanada Pipelines have indicated a \$200 million commitment; the Canadian Development Corp., \$100 million, and Union Gas and Consumers Gas, \$50 million each. Except for the CDC, each of these commitments is subject to the originator being able to incorporate the cost into their rate base (i.e. the utility customers would pay a higher rate to finance the investment). The Northern Border Group (U.S. group sponsoring the connecting facilities) are willing to take more than 50% according to Foothills and they will opt for U.S. interests in the project. Mr. Horte disputed this. Vol. 43
5604-5620
- Clarification of project financing was sought by the Judge and ITC/COPE. Mr. Horte explained that of the total fully powered project cost of \$7 billion, \$5.6 billion would have to be raised on the Canadian side for initial construction with the balance provided from gas revenue. The equity portion of the \$5.6 billion would be Vol. 45
5962-5965

TRANSCRIPT
REFERENCEa-4 Project Financing (Cont'd.)

\$1.4 billion and the debt portion \$4.2 billion. Of the \$1.4 billion equity Arctic Gas feels it can raise at least 50% or \$700 million in Canada along with substantial parts of the debt money.

- The Canada-U.S. pipeline treaty now under negotiation would be helpful in financing the pipeline, according to Mr. Horte in cross-examination by CARC and the N.W.T. Indian Brotherhood. Vol. 45
5785-5789

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6597-6598

a-5 Tariffs

- The MCF-mile method of calculating tariffs, as proposed by Arctic Gas, would result in Canadian consumers subsidizing U.S. consumers, according to Foothills. Mr. Horte disagreed pointing out that the MCF-mile method is that generally accepted by the NEB in allocating costs. After a cost comparison of the MCF-mile method and the Zone Gate method, Foothills suggested that the MCF-mile method proposed by Arctic Gas cost Canadian consumers, including those who might be resident in the north, \$90.2 million more per year than if the Zone Gate method were used (as proposed by Foothills). Mr. Horte disputed the calculation indicating that that figure was about four times too high. He said Arctic Gas will lead evidence on this in the future. In response to the Council for Yukon Indians, Mr. Horte pointed out that the MCF-mile technique was the NEB's most commonly used method. AGT uses a form of Zone Gate method because of its original independence from the NEB jurisdiction. Vol. 43
5621-5636

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6455-6507
6609-6610
- The cost of construction is recovered through the tariffs according to cross-examination by Commission Counsel. Mr. Horte pointed out that the incentives to keep construction costs down were in the regulatory body who approve the plans and in the need to provide a competitively priced fuel. It was pointed out that the Arctic Gas project could deliver gas to the Western and Central United States at a saving of 30 and 80 cents respectively over the El Paso project. The El Paso system would use more fuel in transportation and have less capacity than the Arctic Gas system. Since the customers' prices are fixed by regulatory bodies the savings inherent in the Arctic Gas system would provide greater 'net-backs' to the producers which would, in turn, encourage greater exploration and thereby assure future supplies. Vol. 56
7821-7835

a-6 Reserves

- The forecasts of supply and demand put forward in Arctic Gas's application were questioned by Foothills. It was suggested that Delta Gas would not be required until 1984. The Judge indicated that details of reserves, supply and demand were for the NEB to assess and its findings would be very important to the Inquiry in its consideration of the likelihood and impact of Looping. Vol. 43
5668-5678
- The Old Crow area has been disappointing for exploration companies but the existence of a pipeline through the area would give greater exploration incentive, according to Mr. Horte in cross-examination of CYI. Vol. 50
6698-6699

a-6 Reserves (Cont'd.)TRANSCRIPT
REFERENCE

- The 'solution gas' and 'gas Cap' gas aspects of the Prudhoe Bay and Delta reservoirs were explained by Mr. Horte for ITC/COPE and CARC. Prudhoe Bay has both types while the Delta has mostly gas Cap gas. The solution gas in the oil at Prudhoe Bay will be reinjected into the reservoir when the oil pipeline is finished in 1978. The Prudhoe Bay gas will be available when the gas pipeline is completed one year after the Delta portion is on stream. About 9% of the gas will be used in powering the Canadian part of the pipeline. This does not include getting the gas ready for the pipeline.

a-7 Pipeline Sizing

- A 48-inch, 1,680 psi fully powered pipeline to deliver 4.5 bcf/day is the most efficient system to move the forecast northern gas reserves to markets according to Mr. Horte. Feasibility would be assured with 3 to 3.25 bcf per day. Vol. 42
5543-5546
- The sizing of northern laterals such that they could deliver 9 bcf/day into the main line was discussed by Mr. Horte in chief and in cross-examination by Foothills, CARC and ITC/COPE. Vol. 42
5546-5570
Vol 43
5661-5668
The potential of the producing areas of 4.5 bcf/d along with the reduced necessity of returning Vol. 45
5948-5949
to environmentally sensitive areas for looping, Vol. 49
justify the additional capacity particularly when the overall economics support the oversizing. 6585-6591
If the rate of discovery in the Delta and Prudhoe Bay is disappointing or costs escalate, it may be desirable to opt for 42" alternative as filed. In talking of the North Slope reserves Mr. Horte indicated he included the PET 4 reserves. Vol. 56
7810
- The mainline can't be oversized because present technology limits the maximum size to 48", Vol. 43
5695-5705
according to cross-examination by Foothills. The NEB would make the final decision on lateral sizing. The cost of 48-inch fittings, etc., was taken into account in arriving at the 48" decision.
- The chilling of the gas has some throughput benefits which somewhat offset the cost of Vol. 45
5909-5912
chilling but the benefits do not outweigh the costs, according to ITC/COPE's cross-examination.
- Some of the 48" pipe would have to come from outside Canada to offset the limited capability Vol. 45
5939-5946
of Canadian mills, according to ITC/COPE's cross-examination of Mr. Horte. Arctic Gas would "shop around" for the best deal. The sources of pipe won't be firm until purchase. The Judge pointed out that Mr. O'Rourke's logistics had assumed all pipe would be Canadian. He asked that this be clarified so that shipping routes, off-loading points and the effect on communities could be better evaluated.

TRANSCRIPT
REFERENCEa-8 Looping

- Looping of a pipeline is done in segments determined by the amount of throughput increase desired as determined by supply/demand economics according to Mr. Horte. A chart showing the capacity-looping relationship was shown. Mr. Horte emphasized that looping is directly related to field deliverability which conventionally starts to decrease after 12 to 16 years. Financing of the original project takes this into account. Looping is only undertaken when reserves and supply can support the life of the new facility with consideration given to utilizing the spare capacity in the original facility vacated because of decreased deliverability as described. The regulatory body (NEB) considers all these factors before granting approvals. It was Mr. Horte's view that this pipeline would be fully looped over a period of time. Commission Counsel asked for a diagram showing looping equipment and material disposition on the right-of-way. Vol. 42
5546-5570
- Looping would likely occur in a three-year period after 1985 if reserves of 70 BCFD were achieved, according to Foothills' cross-examination. The likelihood of looping was of concern to the Judge who questioned the impact of a three-year construction program being extended to 12 years with looping. Foothills' interpretation of the figures presented suggests that both the laterals and the main line would be looped by 1985. Mr. Horte disagreed. In the cross-examination by the Indian Brotherhood/Métis Association, Mr. Horte conceded that no studies had been done to support the contention that the looping impact would be less than that of the original construction. The addition right-of-way required would be 35 feet. The availability of borrow material for looping has not been studied. By way of example, the TransCanada pipeline was initially 34" and later looped with two 36" lines and one 42" line, all of which have less capacity than the 48" pipeline as proposed. This illustrates the advantage of going as big as possible initially. Mr. Horte emphasized that the reserves to completely fill the first pipeline haven't yet been found although the potential is high. Looping is not essential for the viability of the project and in any event, it would be subject to approval by the NEB. Vol. 43
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5674-5675
5678-5694
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5923-5926
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5762-5764
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5912-5921
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6669-6677
Vol. 49
6531-6534

a-9 Routing

- Although a route on the west side of the Mackenzie is more direct and originally closer to potential discoveries in that area, an east side route was chosen for three reasons, according to Mr. Horte. They are: (1) Delta discoveries accelerated while the west bank results were disappointing, (2) the Mackenzie Highway was located on the east side, (3) the east route would avoid the difficult river crossings on the west side. Vol. 43
5579-5580
- South of Fort Simpson the route was altered westward from the "gun barrel" route straight to Winnipeg, because of the southern volume splits, according to Foothills' cross-examination of Mr. Horte. It also will fill in the Alberta system as that province's reserves decline, although the system does not now have the capacity to handle the gas. Canadian gas would be split at Caroline with more than 50% going east and the balance west. Vol. 43
5640-5652

- The three routing factors defined by Mr. Horte in chief were questioned by the NWT Indian Brotherhood and Métis Association. The factors cannot be weighted but must be considered in total. The highway would be helpful if it were built. Arctic Gas would be open to other routing suggestions such as on the west side of the river. In cross-examination by ITC/COPE, Mr. Horte said that south of the North Slope, Delta and Beaufort the gas potential is very small and hence had very little routing influence. The highway would be of most benefit during operation and maintenance of the line. Routing close to potential mines, etc., was not really considered in the valley. The Northwest Project had considered the west side of the river but they had decided on the east side prior to the Arctic Gas merger. NES became involved at the merger. Mr. Horte could not recall at what point in route selection the socio-economic consultants were engaged.
- The influence of the highway on the pipeline routing was examined in CARC's cross-examination. At the time of the 1972 merger of Gas Arctic Systems Ltd. and the Northwest Project the east side was favoured. The plan for the highway on the east side was an added reason to go that route. The route including the routing of the laterals was selected prior to the issuance of the 1972 pipeline guidelines. Meetings were held with the government prior to the publication of the Guidelines and the government was probably aware of the routes being considered. No meetings have been held on the cross delta route. The highway would be of assistance but is not essential and its existence would not influence the scheduling of construction. Arctic Gas held no meetings with the Government to discuss the highway although the predecessors to Arctic Gas had done so. CARC pointed out Mr. Hunt's (DIAND) comments from the minutes of those meetings indicating that the highway route would dictate the pipeline location as far as Sans Sault and therefore a mutual agreement was necessary. Mr. Horte indicated that the highway did not decide the pipeline routing except in areas where there was direct conflict. Since Arctic Gas and NES were not formed at the time of the government meetings on record, Mr. Horte could not answer inquiries about the meeting. Highway or not, Arctic Gas would have selected the east routing. Terrain data and existing support facilities are all important in route location. Arctic Gas has had no discussions with the Beaufort Oil Project people on their plans.

a-9 Routing (Cont'd.)	TRANSCRIPT REFERENCE
<ul style="list-style-type: none"> - Evidence on alternative routes will be called at Whitehorse (in August), according to Mr. Horte in cross-examination by the Council for Yukon Indians (CYI). The prime route was selected over the interior route for environmental and economic reasons. A route south of the proposed wildlife range and up the Dempster Highway to Fort McPherson hasn't been considered. There has been no pressure from the U.S. on the Yukon routing. The motivating factor on this international project is to get gas to Canadian and U.S. customers. 	Vol. 50 6682-6687
<ul style="list-style-type: none"> - The location of facilities used in support of a compressor station, such as wharves, airstrips, etc., could be changed even if the compressor station could not, according to Commission Counsel's cross-examination. Loops could be built between stations so their location could be changed but would be subject to a detailed engineering study. 	Vol. 50 6677-6679
<u>a-10 Miscellaneous</u>	
<ul style="list-style-type: none"> - Maintenance of the Mackenzie Highway would be considered by Arctic Gas if it were a condition of the right-of-way permit, according to the Indian Brotherhood's cross-examination of Mr. Horte. Payment for additional barges, wharves, etc., will be negotiated by Arctic Gas. 	Vol. 44 5764-5767
<ul style="list-style-type: none"> - A buried pipeline river crossing is preferred to an overhead crossing even if a bridge is already in existence according to Mr. Horte in cross-examination by Commission Counsel. 	Vol. 56 7860-7862
<ul style="list-style-type: none"> - Abandonment will be addressed by Arctic Gas if they are required to do so according to Mr. Horte. 	Vol. 49 6534-6535
<ul style="list-style-type: none"> - The chilled pipeline was given to NES and test facilities were subsequently established to prove its soundness, according to cross-examination by CARC. Counsel for Arctic Gas pointed out that the previous evidence on El Paso's solution to frost bulb problems at river crossings is not necessarily a solution endorsed by Arctic Gas. 	Vol. 49 6582-6584 Vol. 50 6663
<ul style="list-style-type: none"> - Snow road construction was proposed for a 140 mile section of the Alyeska line but the idea was abandoned because of insufficient snow, according to CARC. 	Vol. 49 6453-6455
<ul style="list-style-type: none"> - Telesat is the favoured communications system for the pipeline at this time although no final decision has been made, according to Commission Counsel's cross-examination of Mr. Horte. 	Vol. 50 6703-6704
<ul style="list-style-type: none"> - Counsel for Arctic Gas responded to previous requests for information as follows: 	
<ul style="list-style-type: none"> - Tables were presented showing typical compressor station equipment and typical equipment on a spread. 	Vol. 50 6646
<ul style="list-style-type: none"> - The pipe used in the Battele test was manufactured by Nippon, Nippon Kokan and Stelco. 	Vol. 50 6646
<ul style="list-style-type: none"> - The surcharging effect of reinforcing bands has not been considered. 	Vol. 50 6648

a-10 Miscellaneous (Cont'd.)TRANSCRIPT
REFERENCE

- Double jointing will be conducted in winter and summer. Vol. 50
6648
- Airstrip equipment was listed and an aircraft usage report will be available in July. Vol. 50
6650
- The dates of data collection at the various test sites was given along with the dates the EPR and Battele-Brooker computer programs were available to Arctic Gas. Vol. 50
6651
- The location of the Swimming Point drill holes and the location of the thermisters was given. Vol. 50
6651-6652
- The pipeline contractors spread reports done for Arctic Gas were again requested to be produced by Commission Counsel. Arctic Gas agreed to provide what information they had. Vol. 50
6652-6663

B. Environmentalb-1 Environmental Review and Surveillance

- A pre-regulatory approval environmental assessment has been done by Arctic Gas, according to Mr. Horte in cross-examination by CARC. The Environment Protection Board (EPB) was part of that process and represents a breakthrough in environmental assessment in Canada. Its input was useful but its continuance is not necessary. Since environmentalists engaged by Arctic Gas are professionals and their work is being reviewed in public hearings, a third party review is not essential although it, of course, would be considered if it was a condition of the right-of-way. Vol. 49
6591-6597
- The role of Mr. Hemstock, director of environmental studies, in the Arctic Gas - NES - EPB relationship was questioned by Commission Counsel. Mr. Horte explained that the NES environmental people and the EPB reported to Mr. Hemstock and hence to the Environmental Committee. Ultimate decision and approval for projects came from the Management Committee. In the construction organization chart, Mr. Hemstock would be under the block entitled Director of Environmental and Community Relations. During construction environmental people would not come under the authority of the construction people. The power to shut down the project if environmental conflicts cannot be resolved will be given to the environmental inspector. Vol. 56
7812-7819

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7863-7866

Vol. 56
7847-7851
- The EPB questioned whether the applicant had the same responsibility to prove the environmental viability of the project as it does to prove the economic viability. Mr. Horte expressed the hope that there would be a single approval and control agency for environmental matters. The Alyeska arrangement with 2 levels of government and many agencies is time-consuming and costly. The NEB is the agency for national social and economic Vol. 43
5705-5714

TRANSCRIPT
REFERENCEb-1 Environmental Review and Surveillance
(Cont'd.)

matters but their authority could be extended to the regional concerns under the public interest aspects of their Act. The Judge pointed out to the EPB that Mr. Horte couldn't interpret how the NEB interprets its mandate. Field control of construction would be handled by design criteria and the various field manuals prepared as part of final decision. The government authority would guarantee compliance. The Arctic Gas application reflects the company views on environmental issues. If there was an environmental catastrophe resulting from the pipeline, Mr. Horte suggested to the CYI that the government would have some responsibility since it granted the certificate. The extent of the government and company responsibilities was beyond his knowledge.

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- The creditability of the applicant on environmental matters was pursued by the NWT Indian Brotherhood by questioning Mr. Horte on environmentally related convictions that are attributable to the consortium's members' activities. After an exchange between counsels, Mr. Horte said he was not aware of any. The Brotherhood cited a \$2,500 fine imposed on Gulf for land use permit violations. The Judge allowed this line of questioning because it would indicate how far it was necessary to go to obtain compliance with environmental protection measures. That is deemed central to the terms and conditions of the right-of-way.

Vol. 44
5748-5759b-2 Route Selection

- The route was not selected in an environmental vacuum, according to Mr. Horte in cross-examination by CARC. The information on the living environment was available prior to route selection and no information obtained since has caused substantial changes. The coastal route is environmentally preferable to the interior route. Both the interior and coastal routes cross the proposed Arctic Wildlife Range in Canada. CARC will lead evidence on this in Whitehorse. Although it is Arctic Gas policy to go around such areas, they can only go so far. The company hopes a crossing permit would be granted with special controls if necessary.
- The pipeline is not felt to be incompatible with the Arctic International Wildlife Range (as proposed in Canada), according to Mr. Horte in cross-examination by Commission Counsel.
- The judgements used by Arctic Gas in responding to environmental and social concerns are one of the aspects to be addressed by the Inquiry, according to Mr. Horte in cross-examination by ITC/COPE. The social and environmental issues are not quantifiable. ITC/COPE asked for the factors used in assessing the route in an area near Arctic Red so that an assessment of the applicant's judgements could be made. Commission Counsel asked for similar information for the Fort Good Hope area where the route goes through the territorial limits of the community. Arctic Gas suggested that this information was premature since it would be covered in later phases of the Inquiry.

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b-2 Route Selection (Cont'd.)TRANSCRIPT
REFERENCE

- Environmental trade-off techniques were not studied by Arctic Gas according to Commission Counsel's cross-examination of Mr. Horte although he admitted such work would be useful. Commission Counsel suggested that techniques developed by Leopold, Pierce, Davies and Fisher on this problem would be useful. Mr. Horte was not aware of those techniques. Vol. 50
6740-6743

b-3 Cross Delta Route

- The cross Delta route was first mentioned in the fall of 1973. Subsequent work has shown that from an engineering and economic point of view, the route is sound, according to Mr. Horte. Work underway this summer will lead to conclusive environmental recommendations in the fall. Judgement will be exercised in determining the acceptable environmental problems and this judgement will then be subject to examination by the regulatory bodies. Whales and dredging will be of prime concern. People in the Delta have not been contacted specifically on the route. The best experts are hired and Arctic Gas does not dictate their study methodology. Anyone at the hearings can present other routes and try to demonstrate their superiority. Arctic Gas then has the option of refusing such a route if it is deemed unfeasible. Vol. 43
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5937-5938
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6518-6521
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Vol. 56
7840-7847

b-4 Fort Simpson Route Amendment

- The Fort Simpson amended routing was put forward as a result of a decision to dual major river crossings, according to Mr. Horte. Environmentalists said the amended route was as good as the original route. A list of studies relating to the amended route will be provided by Arctic Gas within one week and environmental witnesses will be put forward to support the change. Vol. 43
5714-5716
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6521-6525

b-5 Miscellaneous

- The novel engineering problems associated with this project were one factor leading to expenditure on environmental studies that have cost \$14 million, according to Mr. Horte. The test site studies cost an additional \$10 million. Vol. 56
7808-7810
- Counsel for Arctic Gas provided answers to various previous undertakings:
 - A list of compressor station lubricants, chemicals, etc., was provided. Vol. 50
6647
 - NES is checking the air pollution program to assess the effects of wind velocities less than 1 m. per sec. Originally the program didn't account for this. Vol. 50
6647
 - The noise levels at station MO3 were given. Vol. 50
6647

b-5 Miscellaneous (Cont'd.)TRANSCRIPT
REFERENCE

- The air pollution figures are to be expanded. Vol. 50
6648
- The literature survey on the effect of harvesting snow from northern lakes failed to reveal any information. Vol. 50
6649
- The noise rating of line purging was given as 100-110 dba at the valve and 50 dba 100 yards away. Vol. 50
6650-6651

C. Socio-Economicc-1 General Impact

- There is less expertise available in the socio-economic field than in the engineering and environmental areas, according to Mr. Horte in cross-examination by ITC/COPE. Arctic Gas management was therefore the key to the socio-economic impact work. Their ability to do this was less than in engineering matters. The NWT Indian Brotherhood/Métis Association suggested that the long-term effects of the pipeline would not contribute to a stable economy but rather it would lead to the contrary. Mr. Horte maintained that on balance the pipeline would have a positive impact even though it would last only 2 generations and the Native peoples had lived by other means for hundreds of generations. The construction activities are of the greatest socio-economic concern. There will be some minor mile by mile socio-economic impacts but they would be over-shadowed by the overall positive effects. Therefore, engineering and environmental considerations, which are quantifiable, received first consideration. The Brotherhood suggested that the unquantifiable nature of socio-economic considerations could have been overcome by asking people's opinions, values and attitudes in a poll similar to that used by Arctic Gas in its management committee. No such technique was used. Vol. 45
5957-5960
- Some of the proposed sites might have to be shifted as a result of the hearings, according to Mr. Horte in cross-examination by Commission Counsel. The only other input on this subject came from consultants' reports and the staff of Arctic Gas. The policy on use and maintenance of the facilities was flexible to permit local needs to be satisfied. Vol. 56
7866-7869
- The policy on airstrips is that new ones would be built and maintained by Arctic Gas while upgrading of existing facilities would be negotiated with the appropriate authorities such as DOT. Commission Counsel pointed out that the strip at Fort Good Hope is community owned. Vol. 56
7869-7873

c-2 Routing

- Once the route, design and construction planning activities were defined, they were subjected to socio-economic scrutiny with the object of identifying socio-economic consequences, according to Mr. Horte. Vol. 43
5580-5583

c-2 Routing (Cont'd.)TRANSCRIPT
REFERENCE

The main routing concerns were where the line came close to communities. Mr. Horte explained to Commission Counsel that Gemini North and Van Ginkle provided the socio-economic input. No route changes were made for purely socio-economic reasons probably because minor relocations wouldn't change the socio-economic effects. The route along the east side of the Mackenzie would provide benefits to the communities on that side. Socio-economic problems that develop would be handled by company policy rather than re-routing. Many of the policies are outlined in the application such as training programs, crew control, business opportunity, etc.

Vol. 45
5978-5992

- The proximity of the pipeline to communities was based on judgements by Arctic Gas after taking into account engineering, environmental and socio-economic considerations, according to Mr. Horte in cross-examination by the NWT Indian Brotherhood and ITC/COPE. These judgements are now open to public scrutiny and comment. The closer the pipeline is to a community the greater the negative and positive impacts. The pipeline code places certain restrictions on the proximity of a pipeline to a community for safety reasons. The economic distance for gas supply is a function of the distance to the community and the size of the demand. When gas is provided all the customers help pay for the whole facility so that if, for example, the people in Tuktoyaktuk (Tuk) receive gas, their rate would help pay for their proportionate share of the pipeline to Monchy, Saskatchewan. This is normal practice. If it were 'uneconomic' to provide gas to Tuk, Counsel for ITC/COPE pointed out the difficulty in explaining that to the local people when the wells were within sight of Tuk and the U.S. "economic" customers were thousands of miles away.

Vol. 44
5803-5811
5846-5858
- If the FPC selected the Fairbanks corridor, that would lead to a 'no pipeline' situation, according to Mr. Horte in cross-examination by the CYI. However, Arctic Gas is prepared to respond to suggestions on the main route. Compensation for damage caused by the pipeline, such as in the Old Crow area, would be worked out by the normal process with, perhaps, some guidance given by the regulatory bodies where major damage occurred off the right-of-way.

Vol. 50
6691-6697
- Traplines can't be avoided if the pipeline is to be built according to Mr. Horte in cross-examination by ITC/COPE and Commission Counsel. Some attempts have been made to assess the dollar value of trapping and hunting. These socio-economic considerations were made after the pipeline route was selected by NES and Arctic Gas. No major changes resulted from any socio-economic considerations. Mr. Horte agreed that land some may regard as useless bush may be very important to others and therefore it was possible for the route to go through someone's "garden patch" which should be avoided. In the south, land owners such as farmers are consulted in routing a pipeline. On this pipeline in the north, Mr. Horte suggested that people who have an interest in the land could be heard through public hearings. Some sort of compensation might be required. ITC/COPE expressed particular concern about the compressor station to be located at

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TRANSCRIPT
 REFERENCE

c-2 Routing (Cont'd.)

Big Eddy. A decision on moving this station would be forthcoming but Mr. Horte stressed that the cumulative effect of all such changes along the route would have to be assessed as a whole. It was pointed out that Arctic Gas reached a point in its community consultation when they were no longer welcome.

- The Fort Simpson route change made little difference in the socio-economic impact and marginally improved the economies of delivering gas to the communities according to Mr. Horte. Vol. 43
5584

c-3 Compensation for Damage

- The extent and location of traplines were investigated by Arctic Gas's socio-economic consultants, according to Mr. Horte, but it was clear that it was impossible to avoid those areas. It was Arctic Gas's judgement that minimizing environmental disruption was the best way to minimize interference with those traditional pursuits. In response to Commission Counsel, Mr. Horte pointed out that laws exist to compensate land users and the conventional law suit route is open to satisfy claims. Damage can't be assessed before construction and no one is working on the problem of developing a mechanism to expedite claims. In response to cross-examination by CARC, Mr. Horte confirmed that, as for other pipelines, compensation will be made for demonstrated unavoidable losses. The nature of the compensation is a matter of the legal rights of the parties involved. Mr. Horte declined to comment on the article in the James Bay Agreement which dealt with compensation for trapline disturbance. The James Bay Agreement was filed as an exhibit. Vol. 43
5583-5584
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6622-6623
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6667

c-4 Inspectors

- The use of socio-economic inspectors on the project was questioned by the NWT Indian Brotherhood. Mr. Horte indicated that each survey crew would have such an inspector to guarantee compliance with company procedures and attend to community concerns on pipeline matters. Counsel for the Brotherhood then introduced as exhibits correspondence dealing with NES's request for a land use permit for work this summer on the proposed right-of-way near Fort Good Hope. There were no inspectors in the crew specified on the permit application. Correspondence from Fort Good Hope showed that they opposed the proposed work and would boycott it if it was allowed to go ahead. Mr. Horte said he wasn't surprised that Native people would reject jobs on a pipeline-related project. The lack of an inspector was contrary to the statements made by the Arctic Gas in its application before the Inquiry even though the work to be undertaken was similar to the work to be done after pipeline approval. After looking into the matter, Counsel for Arctic Gas explained that the crew would be briefed prior to the job and the work would be inspected twice by an environmental inspector. Consultation with Fort Hope, in this case, was the responsibility of the Government officials. Vol. 44
5736-5748
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5881

c-5 Land TitleTRANSCRIPT
REFERENCE

- Arctic Gas is confident it can negotiate for the land it needs in the N.W.T. with whoever owns it, according to Mr. Horte in cross-examination by the N.W.T. Indian Brotherhood. After the pipeline is abandoned, the right-of-way land rights would expire and "fee simple" lands would remain in the company's ownership. About 40 square miles of land is involved. The Legal Committee of Arctic Gas hasn't done any studies on the status of Native land claims in the N.W.T. Financing of the pipeline would be based on the assurance that the company could cross the land in the N.W.T. which is now subject to claim.

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c-6 Gas to Communities

- Servicing at community is dependant on the distance it is from the pipeline and the demand for gas in the community, according to Mr. Horte in cross-examination by the N.W.T. Indian Brotherhood. Where this combination proves gas delivery to be economic, gas will be made available and Arctic Gas would build the main lateral. Where gas delivery is uneconomic, the decision on servicing the community would have to be made by government since it would require a subsidy. Arctic Gas would make the gas available if requested to do so by the government. The economically serviceable communities are Inuvik, Norman Wells, Fort McPherson, Fort Simpson, Fort Good Hope and Aklavik. Other communities would be economic if a common cost price system were used. Tuktoyaktuk is not economic nor is Yellowknife, Pine Point or Rae Edzo. Hay River would be economic if the load of the foregoing were on the line. The Brotherhood pointed out that Foothills proposed to supply all communities from Great Slave Lake North including Tuktoyaktuk.

Vol. 44
5767-5783
- The Department of Indian and Northern Affairs had indicated to Arctic Gas that community gas supply should be carefully considered, according to Mr. Horte in cross-examination by ITC/COPE. Mr. Hunt, Mr. Yates and others were at those meetings. The communities themselves were not approached. The Judge indicated that Arctic Gas's position on gas delivery to communities could be challenged and arguments could be heard regarding preferential treatment for Northern consumers.

Vol. 45
5905-5909
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5620-5621
- The economics of serving Old Crow and Whitehorse if the interior route were chosen would be investigated, according to Mr. Horte. If they were supplied it would be with American gas which would be made up later down the pipeline with equivalent Canadian gas.

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6679-6682

c-7 Employment and Training

- The Northern Training Program was started by Alberta Gas but is now administered by Arctic Gas, according to Mr. Horte in cross-examination by Foothills. Not many trainees have been placed at Arctic Gas because it is not an operating company. The people of the north are of great advantage to the pipeline project and the training programs for northerners will pay off, according to cross-examination by the N.W.T. Indian Brotherhood. Mr. Horte outlined the fluctuation

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5636-5639
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5791-5794

c-7 Employment and Training (Cont'd.)TRANSCRIPT
REFERENCE

- in the number of jobs over the construction period emphasizing that the manpower graph issued previously was for the whole job north and south of 60. When the pipeline is fully powered there will be 208 employees. The Judge requested a manpower diagram showing only the jobs north of 60. Vol. 44
5721
- The number of jobs anticipated if the pipeline is looped was outlined for the Judge by Mr. Williams of NES. Assuming the line is looped over 3 years the number of workers would be 3,200 or 5,000 depending on whether each crew did 3 or 2 interstation loops each respectively. The initial construction crew peak of 8,700 is for the whole project. Only 6,000 of these would be in the N.W.T. and Yukon. Vol. 43
5578-5578
 - The effect of high wages in the pipeline employment was bound to present some regional problems for the north's economy, according to Mr. Horte in cross-examination by Commission Counsel. The attractiveness of these wages would draw people away from other jobs. Overtime restrictions or extended rotation periods to normalize the wages have not been considered. Government direction would have to be forthcoming to balance such economic impacts. In response to the Judge's questions Mr. Horte said that wages would probably be similar to those being paid on Alyeska. Vol. 56
7852-7858
 - Only the Natives can say whether a land claims settlement would further the likelihood of Native employment on the pipeline, according to Mr. Horte in cross-examination by CARC. Arctic Gas's objective is to see that they have the opportunity. CARC suggested that the Native boycott of the James Bay Project and the Fort Good Hope boycott of a pipeline-related project in that area indicated a potential for a boycott of the pipeline project. Some workers from outside Canada, probably from the U.S., would be used on the pipeline. Vol. 49
6575-6582

c-8 Miscellaneous

- Arctic Gas has spent about \$1.5 million on socio-economic studies according to Mr. Horte. Vol. 56
7809-7810
7863
- The cross Delta construction would involve about 150 men but there would be no camp located near Tuktoyaktuk, according to counsel for Arctic Gas. Vol. 50
6649

Miscellaneous

- The Judge said he would be going to Old Crow at the invitation of the people there and then would carry on to visit Alaska. Later he described that trip. Witnesses from Alaska would be heard later in the year. Vol. 42
5452-5453
Vol. 56
7800-7804
- The Judge suggested to the participants that they prepare, at the end of each phase, their arguments in support of the terms and conditions they wish to urge with respect to environmental and socio-economic conditions. These written arguments would be required from each participant at the end of the Inquiry and should contain reference to transcripts and exhibits. The community hearings should not be overlooked. The settlement of Native land claims and delivery of gas to communities were subjects of probable submissions used as examples by the Judge. Vol. 44
5812-5819

E. Inquiry ScheduleTRANSCRIPT
REFERENCE

The Inquiry Schedule is shown below. At the formal hearings, the intent is to have the Foothills evidence on phase 1 completed by the end of September. Then phase 1 witnesses of the various participants would be heard as well as the balance of the evidence on alternative corridors.

Community hearings may be held in Yellowknife in the evenings concurrent with the formal hearings during either September or October.

<u>SEPTEMBER</u>	-	1 - 5	No sitting
		8 - 12	Fort Simpson, Wrigley & Jean Marie River Community hearings
		15 - 26	Yellowknife formal hearings
		29 - 30	No sitting
<u>OCTOBER</u>	-	1 - 3	No sitting
		6 - 10	South Slave Community hearings
		14 - 24	Yellowknife formal hearings
		27 - 31	No sitting
<u>NOVEMBER</u>	-	3 - 21	Yellowknife formal hearings
		24 - 28	No sitting
<u>DECEMBER</u>	-	1 - 19	Yellowknife formal hearings
		22 - 31	No sitting

Policy and Planning
ACND Division
July 21, 1975
August 21, 1975

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES 56, 57, 58 and 59)

Yellowknife, N.W.T.
AUGUST 18, 19, 20 and 21POLICY - FOOTHILLS PIPE LINES LTD.

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TOPIC: Phase I: Engineering and Construction of the Proposed Pipeline

Panel on: Policy - Foothills Pipelines

DATE: August 18 to 21, 1975 in Yellowknife

WITNESSES: Panel on Foothills Policy

- Mr. S.R. Blair: Chairman and Chief Executive
Officer of Foothills Pipelines Ltd.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

(a) Technical/Engineering

a-1 Corporate Background

- The evolution of the Foothills Pipelines Company through its parent company's, (Alberta Gas Trunkline) participation in the Gas Arctic Systems and Canadian Arctic Gas Study Ltd., was described by Mr. Blair. From the beginning, it has been the policy of the parent company to move Arctic Gas into northern Alberta to utilize existing systems within that province and to use Canadian Companies with U.S. companies as customers - not co-owners and operators. The original Gas Arctic group initiated the EPB, 2 test sites, experimental systems on the AGTL system and the training of northerners. The Gas Arctic - Northwest Project Study Group merger took place in June 1972. By 1974 there were 28 companies in the consortium. In May of 1974 some began withdrawing and AGTL withdrew in September of that year. AGTL's decision was based on the predominant U.S. influence and the misleading and subordinate role of Canadian participants in Arctic Gas. This was reasserted in re-examination by Foothills. Vol. 56
7896-7914
- The steps leading to the formation of the Gas Arctic Group were contested by Arctic Gas in their cross-examination of Mr. Blair. It was then pointed out that the original Gas Arctic Systems' proposal was based on the only proven frontier reserves that were known at that time - those in Alaska. Canadian Arctic Gas then showed that their consortium still had three major Canadian distribution companies, the Alberta Natural Gas Transmission Company and the Trans-Canada Pipelines Company amongst its membership. These are part of the Canadian non-producer group. Vol. 57
7948-7979
- The CAGSL project's foreign conception and leadership statement of Mr. Blair was contested by Arctic Gas in cross-examination. Arctic Gas pointed out that the Canadian non-producer group had veto powers and the management of the Canadian Arctic Gas consortium was 86% Canadian. Mr. Blair maintained that the consortium's project has evolved primarily to serve the objects of foreign companies and foreign purposes with the main management influence originating in the foreign companies. Arctic Gas pointed out that Westcoast Transmission's, (who, along with AGTL, form Foothills) largest shareholder is Pacific Petroleum whose largest shareholder is a U.S. company, Phillips Petroleum. Vol. 57
7981-8004

a-1 Corporate Background (Cont'd)TRANSCRIPT
REFERENCE

- Westcoast Transmission is classified by the Financial Post as an American controlled company according to cross-examination by Commission Counsel. Mr. Blair disagreed by stating that, although the largest shareholder may be foreign controlled, his experience was that the Westcoast decisions were made in Canada in the Canadian interest. Commission Counsel suggested that if 6 conditions were met by Arctic Gas Foothills' objections to that company disappear These conditions were: (1) Delta gas to Canadian markets as needed, (2) no cost to Canadians for carrying U.S. gas, (3) sensitivity to governments in Western Canada and the N.W.T., (4) scale project to manageable size, (5) maintain a cautious and prudent approach wherever possible on such a precedent-setting project and (6) sensitivity to population along the route i.e. gas to communities. Mr. Blair stated his opposition to the Arctic Gas project would still remain because of its foreign control and because it would by-pass existing systems in Alberta. He reaffirmed this view in re-examination. Vol. 58
8253-8269
- AGTL entered the CAGPL consortium but was unhappy with many of its clauses, according to Mr. Blair in cross-examination by Arctic Gas. He pointed out that he could not go into detail about his reservations unless Arctic Gas released him from the confidentiality of those discussions. Arctic Gas then explored the corporate structure of AGTL and its' self-regulatory powers in setting tolls and rates. Mr. Blair pointed out that AGTL (Canada) was a subsidiary of AGTL with the purpose of providing a Federal Company under Federal control (NEB) to move Arctic Gas across Alberta. It would obtain from its parent company the facilities necessary to do this. The result would be a federally regulated pipeline within 5 years, either by new construction or acquisition. Arctic Gas suggested that an AGTL subsidiary company; Pan Alberta, had applied for export of Alberta gas at the time that AGTL was saying that there was no Delta gas surplus to Canadian needs. The details supplied by Foothills tended to refute that argument. Vol. 59
8006-8049
8114-8115
- Foothills does its own engineering management with its own staff and since the break from Arctic Gas, Foothills has been building its own expertise to replace what was done by others at Arctic Gas, according to Commission Counsel's cross-examination. Foothills now has a staff of 50 backed up by one of Canada's largest pipeline engineering groups (at AGTL). Vol. 59
8301-8302
Vol. 58
8211
- Foothills does its own engineering management with its own staff and since the break from Arctic Gas, Foothills has been building its own expertise to replace what was done by others at Arctic Gas, according to Commission Counsel's cross-examination. Foothills now has a staff of 50 backed up by one of Canada's largest pipeline engineering groups (at AGTL). Vol. 58
8274-8277

a-2 Project Description

- The Maple Leaf project which includes the Foothills, AGTL (Canada), AGTL and Westcoast pipelines was described by Mr. Blair using slides. The main differences between this project and that of Arctic Gas are: (1) it transports Canadian gas to Canadian markets, (2) it provides for N.W.T. community gas, (3) it utilizes spare capacity on existing systems in Alberta and plans the looping of those lines as required. The cost figures also account for expansion and operation of the Trans-Canada system. Foothills does not propose any line in the Northern Yukon. Vol. 57
7892-7896
Vol. 56
7914-7921
7937
Vol. 57
8077-8091

	TRANSCRIPT REFERENCE
<u>a-2 Project Description (Cont'd)</u>	
- The spare capacity anticipated by year and by location on the AGTL system was requested by Arctic Gas in cross-examination. Foothills agreed and Mr. Blair pointed out that after 1979 or 1981 the net decrease in Alberta production will provide the spare capacity. Arctic Gas went on to suggest that one principle behind the Foothills project was the avoidance of Federal-Provincial jurisdictional disputes.	Vol. 57 8094-8098 Vol. 56 7928-7933 Vol. 57 7979-7981
- AGTL does not operate field gathering lines and plants, according to Mr. Blair in answer to the Judge's questions. At Pointed Mountain AMOCO operates the field gathering and plant facilities and Westcoast transports the gas south where it undergoes further processing.	Vol. 57 8049-8052
- Foothills did a complete conceptual and engineering review to produce their application according to cross-examination by CARC. Except to avoid adverse social impact, Foothills would not duplicate facilities. They would use the Mackenzie Valley highway if it were available but their plans only anticipated it built as far as Wrigley. Although the highway would be of value, it is not necessary for this project.	Vol. 58 8183-8187
<u>a-3 Sizing and Economics</u>	
- A 42 inch pipeline is adequate for Canadian needs until 1985 after which forecasting becomes uncertain, according to Mr. Blair. This is based on the traditional approach to sizing which is based on supply, markets, costs, material availability, the reserve base and deliverability. An oversized pipeline places a cost burden on the consumer. Caution dictates using a smaller pipe with looping used later to match capacity to the market requirements.	Vol. 56 7921-7925
- The level of reserves necessary to make the Foothills project feasible was questioned by Arctic Gas. Mr. Blair indicated that there was no single number but the project was considered viable on the basis of their consultants' estimates of 7.2 TCF (proven/probable) growing to 18 TCF over the next several years. It was pointed out by Arctic Gas that with 7 TCF reserves a daily production of about 1 BCF could be sustained over the 20 project life necessary for financing. This volume in a 42" line would be less than 40% of the capacity. By comparison Arctic Gas' 48" line carrying 1 BCF from the Delta and 2.25 BCF from Alaska would be at 72% of its capacity. Mr. Blair noted that a comparison would have to go further than this to consider costs, reserves, supply material availability, etc. He conceded that a 48" line was appropriate to carry the combined Delta and Alaskan gas volumes indicated by Arctic Gas subject to the material availability. He also noted that Arctic Gas' proposal had one 48" line entering Alberta from the north with one 48" and two 42" lines going out the south. This indicates to him that all Alaskan and Delta gas would go to the U.S. Despite Mr. Horte's statements at the Inquiry to the contrary, it was noted that the CAGPL application before the NEB still shows half of the Delta gas being exported.	Vol. 57 8053-8057 Vol. 57 8064-8077
- The real issue leading to the breakaway of AGTL from CAGSL was the ownership and control of the pipeline through Alberta, according to Arctic Gas in their cross-examination. They contended that the volumes of gas to be moved across the province would require a completely	Vol. 57 8098-8114 Vol. 58 8116-8128

a-3 Sizing and Economics (Cont'd)TRANSCRIPT
REFERENCE

new system. Mr. Blair doubted this and pointed out that other factors come into play when considering expanding an existing facility as opposed to building a new one. These are: (1) the build-up of gas volumes would be slow, making it possible to extend the expansion over many years with all the financial advantages that entail, (2) utilization of existing and operating support facilities, (3) environmental advantages of using an existing right-of-way (in looping) etc. Mr. Blair went on to point out inconsistency in parts of the Arctic Gas tariff calculations. The aggregate capacity as designed is 6.9 BCF/day with the tariff calculations on the U.S. portions based on 6.9 BCF per day. This indicates an export oriented system, according to Mr. Blair.

- The community delivery laterals will require a capital expenditure of \$72 million and have an annual cost of service of \$11 to \$12 million according to cross-examination of Mr. Blair by Arctic Gas. This would achieve a net saving of \$500 per serviced N.W.T. household if the subsidy plan proposed by Foothills were in effect. Assuming 6,500 households, Arctic Gas pointed out that the total annual "saving" would be \$3.25 million (6,500 x \$500) which would "cost" \$11 to \$12 million annually. Mr. Blair pointed out that economic efficiency was just one factor adding that Foothills felt that when they take something out of an area, something should be done for the people who live there. Vol. 58
8131-8137

a-4 Costs and Financing

- Fifty per cent equity in the Arctic Gas project represents \$700 million which would be difficult to raise in Canada for a project geared largely for the U.S. economy, according to Mr. Blair. The Foothills project, on the other hand, requires \$1,775 billion in capital of which \$131 million would be generated by sales of preferred shares and \$313 million by common shares. The balance would be raised by debt. Foothills is confident that these sums could be raised in Canada for such a Canadian project. Vol. 56
7934-7937
- Financing is based on present reserves and the potential of an area, according to Mr. Blair in cross-examination by Arctic Gas. The first mortgage component would be 57% of the debt or \$771 million out of \$1,775 million. Arctic Gas questioned the availability of first mortgage money in the absence of reserve assurances that would result in amortization of the line over the life of the bonds. It was suggested by Mr. Blair that the urgency of the project and guarantees by the federal and/or provincial governments might assist financing. Vol. 57
8057-8062
- The costs associated with the entire Maple Leaf project were outlined by Mr. Blair for the Judge. The initial capital requirement for Foothills is approximately \$1.8 billion with the estimated capital requirements for the other parts of the Maple Leaf project being: (a) Westcoast \$300 million, (b) AGTL \$500 million and (c) Trans Canada \$700 million. The total is approximately \$3.3 billion with a total of \$4.5 billion required when the Foothills line is fully loaded (in its 5th year). Vol. 57
8091-8093
- The funds required for the Foothills project were outlined by Mr. Blair for Commission Counsel. The cumulative investment in plant, property and equipment (without depreciation or amortization) is estimated at \$1,791 billion in 1979 to provide 800 MCF/day and \$2,300 billion in 1982 to provide 2.4 BCF/day. The debt part of the Vol. 58
8279-8288

TRANSCRIPT
REFERENCEa-4 Costs and Financing (Cont'd)

project is planned to be financed as follows: (a) \$321 million for Canadian first mortgage bond private placement investors, (b) \$300 million in the U.S. first mortgage bond private placement investors, (c) \$335 million from the Canadian Banking Syndicate, and (d) \$125 million from the U.S. Banking Syndicate. It is a policy of Foothills not to accept foreign equity. This would exclude foreign owned Canadian companies including the principal oil companies.

a-5 Route, Alaskan Gas and other Reserves

- Alaskan gas could be carried on the Maple Leaf project if the Government of Canada felt this was desirable, according to Mr. Blair. However, not all Alaskan gas should be carried since the hazards outweigh the benefits. Specifically, there would be difficulty in raising capital for a U.S. oriented project, and there would be regulatory, rate making and sovereignty concerns and responsibilities. In response to CARC's cross-examination Mr. Blair said that there would be a "real possibility" to move Alaska Gas although Foothills was not proposing to do so. In response to the N.W.T. Indian Brotherhood/Métis Association cross-examination, Mr. Blair reiterated that if asked to move Alaskan gas, they would be prepared to do so. However, Foothills wasn't seeking it, they don't want it and weren't applying for it. This view was repeated in cross-examination by Commission Counsel. It was Mr. Blair's feeling that about 400 to 600 MCF/day of Alaskan gas could be carried although more or less could perhaps be transported.

Vol. 56
7925-7928
Vol. 58
8176-8177

Vol. 58
8199-8204

Vol. 58
8233-8236

Vol. 58
8269-8272
- The location of potential reserves and their influence on the Foothills route was addressed in CARC's cross-examination. Mr. Blair agreed that the potential of the Mackenzie Basin played a role in selecting that as a route for the pipeline. Future development would probably be northward into the Beaufort Sea although there could be surprises in the southern N.W.T. The Judge asked Mr. Blair to comment on Mr. Hemstock's reading from a U.S. Department of Interior report grading of future gas sources as: (1) Beaufort Sea (2) Eagle Plains and (3) Mackenzie River area. Mr. Blair graded the potential as: (1) Beaufort Sea, (2) Arctic Islands, (3) Southern N.W.T. and (4) Eagle Plains. It was suggested by Mr. Blair that some of the Arctic Islands gas could be routed through a Mackenzie Valley pipeline either by conventional pipelines as in the case of Banks and Victoria Islands or by delivery from LNG tankers.

Vol. 58
8180-8183
8187-8194

a-6 Pipe

- All the pipe for the Foothills project would be 42" and all would be made in Canada, according to Mr. Blair. AGTL has ordered pipe identical to that required on the Foothills project from Stelco and Ipsco and this will provide them with experience before installation in the North. It was suggested that Arctic Gas was out on a limb with the class and design of pipe they propose. Such pipe has never been used or supplied in North America.

Vol. 56
7942-7945

a-6 Pipe (Cont'd)TRANSCRIPT
REFERENCE

- The Canadian content portion of the Arctic Gas pipe tonnage is greater than 50%, according to Arctic Gas cross-examination, and this represents more tonnage than the Foothills project. Vol. 58
8128-8131
- A 42" high pressure line could carry 2.8 BCF and with additional wall thickness, could carry over 3 BCF, according to Mr. Blair in cross-examination by Commission Counsel. The El Paso proposal is for a 42" line carrying 3.9 BCF. These limitation are important when considering the possibility of looping. Vol. 58
8272-8274

a-7 Looping

- The proposed 42" line is sufficient to handle the reserves projected into the 1990's indicating that looping will probably not be necessary for Delta gas, according to Commission Counsel's cross-examination of Mr. Blair. If other northern gas were to be moved looping may be required. If the pipeline were loaded to the limit of the code, it could carry up to 2.8 BCF/day. Vol. 58
8277-8278

a-8 Regulatory Process

- The independent review process such as the EPB is fully supported by Foothills and AGTL, according to Mr. Blair in cross-examination by CARC. It was pointed out that Mr. Blair was the person instrumental in setting up the EPB with Mr. Templeton. Vol. 58
8194-8196
- A single regulatory body to review and control construction would be nice and efficient but the project could be executed with a fragmented authority, according to cross-examination of Mr. Blair by CARC. He is satisfied with the NEB, the Territorial Government and the Federal Government. Vol. 58
8196-8197
- To illustrate the fact that jurisdictional divisions are handled as a matter of course, Mr. Blair, in re-examination traced the delivery of gas from Alberta to Toronto through AGTL (under the jurisdiction of the Alberta Utilities Board) to Trans Canada (under Federal jurisdiction) to the U.S.A. (under the F.P.C. jurisdiction) to Sarnia and hence to Toronto and the Consumers Gas Company. Vol. 59
8303-8305

(B) Environmentalb-1 General

- The option exists to refuse a pipeline permit on the basis of inadequate environmental protection measures, according to the EPB's cross-examination. Mr. Blair said that the studies, field work and present review process will demonstrate that the measures proposed are adequate to protect the environment. Foothills relies on its own work and commitments and not those of Arctic Gas. Work is ongoing to supplement the work as filed. The environmental effects of developing other reserves can't be assessed in detail until the discoveries are made. The EPB stressed that the Delta was environmentally a key area to the north and assurances must be forthcoming on the adequacy of contingency plans. Vol. 58
8143-8147
Vol. 58
8154-8158
Vol. 58
8162-8164

TRANSCRIPT
REFERENCE

b-2 Routing and Looping

- Special environmental interest areas such as fish breeding grounds, centers of high animal populations, areas of difficult soils, etc., were avoided as much as possible in routing the line, according to Mr. Blair in cross-examination by CARC. Vol. 58
8198-8199
- The environmental effects of looping are not great enough to justify oversizing the original line, according to cross-examination by the EPB. Looping is generally routine and usually doesn't justify an elaborate impact analysis. In any event, NEB and land use approvals must be sought and these could include environmental work. The Foothills project without looping is sufficient for reserves up to 30 TCF. The potential reserves in the Delta are estimated from 39 to 80 TCF so the likelihood of looping will depend on discoveries, markets, etc., and the Canadian Government's decision on the desirability of moving Alaskan gas across Canada. Looping is a subject for the regulatory bodies at another time. Vol. 58
8174-8176
Vol. 58
8158-8161

b-3 Contingency Plans

- The performance of AGTL and Westcoast in northern Alberta, northern B.C. and the N.W.T. is indicative of the intent of Foothills to follow all terms and conditions to protect the environment. Other panels will present the site specific undertakings proposed. Vol. 58
8151-8154
8177-8180

b-4 Environmental Training

- Foothills is committed to training its inspectors in environmental protection, according to Mr. Blair in cross-examination by the EPB. The companies' inspectors will not be under the contractor's jurisdiction and each one has the authority to shut down an operation. The chief inspector will have the authority to shut down a whole spread. Vol. 58
8150-8151

b-5 Alyeska Controls

- The controls proposed for the Alyeska project were largely circumvented by the assertions of individual rights and by powerful unions, according to the EPB. On this pipeline, liquor could not be banned, according to Mr. Blair. Control of guns, vehicles and such things as wildlife harassment would be easier. (also see section c-3 below) Vol. 58
8164-8168

(C) Socio-Economic

c-1 General

- The process and influence of socio-economic input to Foothills was pursued in the N.W.T. Indian Brotherhood/Métis Association's cross-examination. Mr. Blair described how socio-economic factors are channelled through the Director of Operations (John Burell) to the Executive Vice-President (Howard Hushin). Foothills is interested in and concerned about socio-economic matters and has given them serious weight. Tangible results can be seen in the employment policies, the establishment of the business advisory board, and the construction practice proposals. Mr. Blair described the major socio-economic impacts of the pipeline as (1) providing a large source of revenue for Vol. 58
8214-8233

c-1 General (Cont'd)TRANSCRIPT
REFERENCE

the Territories which would make it entirely self-supporting for the first time and, (2) the impact of construction with the related transportation and communication systems. The impact of a pipeline is probably less than any other major civil engineering project. The existence of a pipeline will also have implications for future development in the nature of increased exploration. Mr. Blair pointed out that elsewhere the existence of a pipeline doesn't instigate other industrial developments. These developments are generally confined to the downstream end of the pipeline. By way of example, it was pointed out that the pipelines in north-western Alberta have had little effect in generating or attracting other businesses. They do however, generate a significant proportion of the taxes and some jobs.

- Foothills will be going back to many communities to get a better cross-section of opinion on socio-economic matters, according to cross-examination by ITC/COPE. Mr. Blair pointed out that some communities had opposed meetings because they felt that any discussion would prejudice their land entitlement negotiations. Vol. 58 8237-8241

c-2 Gas to Communities

- By including the proposal to supply communities with gas in its application, Foothills has taken the responsibility of arguing the case before the regulatory bodies, according to Mr. Blair. It will cost about \$72 million to engineer and build these laterals and \$11 to \$12 million annually to operate. This cost is more justified than the \$150 million extra cost of oversizing the Arctic Gas pipeline in Mr. Blair's opinion. The net annual saving to northerners would be \$500 per household. The subsidy to effect this would add an extra 25¢ per month to a Toronto householder's fuel cost. Vol. 56 7937-7942
- In arriving at the \$500 saving per household many projections had to be made, according to Mr. Blair in cross-examination by Commission Counsel. He agreed to have a calculation for a sample community produced. Distribution of the gas would normally be done by others but if necessary Foothills would undertake to have it done either by a joint venture or a subsidiary company. Vol. 58 8288-8293
- The gas load of the communities would be about 15 MCF/day or about 1% of the mainline throughput according to ITC/COPE's cross-examination of Mr. Blair. There would be no problem in getting this gas and assuring its continued supply. Vol. 58 8241-8243

c-3 Controls

- The problems of controlling guns, alcohol, vehicles and aircraft were discussed by Mr. Blair in cross-examination by the EPB. Although all policies are not firm, some indication of intent can be seen in the performance of Foothills sponsor companies. From his experience, Mr. Blair said that strict gun controls could be effective and some controls on alcohol could be implemented. Total banning of alcohol wouldn't be realistic. By keeping the camps away from the communities and restricting the use Vol. 58 8147-8149 8169-8173

TRANSCRIPT
REFERENCE

c-3 Controls (Cont'd)

of vehicles, the workers could be kept away from the towns. Controls on aircraft already exist for other reasons and new controls could be effectively implemented.

- Northern residents cannot be restricted from working on the pipeline just to decrease the social problems in the communities, according to Mr. Blair in cross-examination by ITC/COPE. High wages are a fact on pipeline construction and there would have to be ways other than lower wages to minimize impact. Employment opportunities would be designed as much as possible to fit the ongoing life in the communities. Vol. 58
8250-8252

c-4 Training Programs

- The twenty-six AGTL employees from the Nortran program would probably come back to work on the construction and operation of the pipeline, according to Mr. Blair in cross-examination by ITC/COPE. This would go a long way in providing the inspection and operating staff. In construction the number of jobs for northerners would probably only be limited by the number of applications. The number of certified tradesmen on pipeline projects is quite small and there should be no practical barriers to have unions accept northerners. Vol. 58
8243-8249
- The total cost of the Nortran project from 1970 to June 1975 has been \$966,689.00 according to Counsel for Arctic Gas. The Arctic Gas administrative costs from July 1973 to June 1975 have been \$582,000 making a total cost of \$1,548,689. Vol. 59
8328-8329

c-5 Miscellaneous

- The concerns of the Fort Simpson Band Council about the Fort Nelson highway were mentioned by the N.W.T. Indian Brotherhood. Mr. Blair had no policy comment but indicated that two Foothills people were in Simpson and could discuss the matter with the Council. Vol. 58
8236-8237

(D) Miscellaneous

- Foothills filed all the relevant portions of its application as exhibits and indicated they had provided a display room containing models, photographs and various documents relating to their proposal. Vol. 56
7878-7887
- Commission Counsel advised the Inquiry of a list of documents recently submitted by DOE. They also advised the Inquiry of documents relating to the Foothills application produced by Foothills and supplied to the Inquiry through D.I.A.N.D. Vol. 59
8329-8332
Vol. 58
8156-8157
- Foothills told the Inquiry the subjects of its Phase 1 panels: (1) Policy (Mr. Blair) (2) Why the pipeline is needed, (3) Location, (4) Hydraulics and connecting facilities, (5) Pipeline design, (6) Communications, (7) Station Design, (8) Materials engineering (9) Geotechnical, (10) Construction planning, (11) Operation and maintenance, (12) Alternative systems and (13) Policy (if necessary a second time). The Judge reminded Foothills of the Minister's letter of referral advising that the differences be studied. Vol. 57
7947
8005-8006

(D) Miscellaneous (Cont'd)TRANSCRIPT
REFERENCE

- Arctic Gas advised it will be proposing a change in the Inquiry rules so that both participants file their prepared evidence at the same time. Vol. 58
8209-8211
- The Inquiry timetable for the balance of 1975 was provided. Vol. 58
(see (e) Inquiry Schedule below) 8205-8209
8212-8214
- After hearing arguments on the relevance of Foothills' second panel's evidence entitled "The Need for the Pipeline, Canadian Natural Gas Requirements" the Judge ruled against hearing the evidence, noting that it was a matter for the NEB. The Inquiry therefore moved on to panel 3 on pipeline location. Vol. 59
8305-8328
Vol. 60
8482-8484

(E) Inquiry Schedule

The Inquiry will continue with the Foothills Phase 1 panels with the object of completing them by the end of September. Then Commission Counsel will call for cross-examination any members of the PAAG team required and those overview witnesses deemed appropriate. After the participants and Commission Counsel's witnesses appear the applicants will call their reply evidence. Then the corridor evidence begun in Whitehorse will be wound up before going into phase 2 - probably by November.

<u>SEPTEMBER</u>	-	8-12	Community hearings Fort Simpson, Wrigley and Jean Marie River
	-	15-26	Yellowknife formal hearings
<u>OCTOBER</u>	-	6-10	Community hearings, South Slave Area
		14-24	Yellowknife formal hearings
<u>NOVEMBER</u>	-	3-21	Yellowknife formal hearings
<u>DECEMBER</u>	-	1-19	Yellowknife formal hearings

Note

The Judge indicated that in the City of Yellowknife, community hearings may be held in the evenings concurrent with the formal hearing during September or October.

The N.W.T. Brotherhood/Métis Association indicated that it may wish to have the North Slave community hearings (Rae and Fort Providence) in November.

Policy and Planning
ACND Division
August 28, 1975

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES 59 & 60)

Yellowknife, N.W.T.
AUGUST 21 and 22, 1975

LOCATION OF THE FOOTHILLS PIPELINE

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TOPIC: Phase 1: Engineering and Construction of the Proposed Pipeline.

Panel on: Location of the Foothills Pipeline

DATE: August 21 and 22, 1975 in Yellowknife

WITNESSES: Panel on the Location of the Foothills Pipeline.

- Mr. E.A. Mirosh: Manager, Engineering, Foothills Pipe Lines Ltd.
- Mr. M.A. Fawcett: Supervisor, Surveying, Foothills Pipe Lines Ltd.
- Mr. L. Bouckhout: Supervisor, Environmental Affairs, Foothills Pipe Lines Ltd.
- Mr. K. Gillespie: Engineer, Klohn Leonoff Consultants Ltd.
- Mr. C.W. Drew Jr.: Geologist, Sproule Associates Ltd.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

(A) Technical/Engineering

a-1 Route Selection

- The routing differences between the Foothills and CAGPL lines were described by Mr. Mirosh. The central 400 miles of each route are similar with differences in the northernmost and southernmost 200 mile sections. Foothills has no Alaskan lateral and therefore goes to the east of the CAGPL line near Travaillant Lake. Near Fort Simpson, Foothills skirts the Ebbuit Hills IBP site adding about 1.5 miles to their route compared to the CAGPL route. Vol. 59 8333-8340
- The criteria used to establish the route were described by Mr. Fawcett as: (1) restrictive terrain, (2) environmentally sensitive terrain, (3) wildlife and fish, (4) soils, (5) route access, (6) proximity to communities, (7) permafrost and geotechnical considerations, (8) the shortest possible route. On this basis northern and southern 200 segments in the Territories were re-routed and the community lateral routings were established. Consideration was given to other corridor transportation modes such as the highway. In this regard only the Little Chicago and Gibson Gap areas proved restrictive. The terrain sensitivity established by Sproule Ltd. was also used although Mr. Fawcett could not recall any re-routing resulting directly from it when cross-examined by Arctic Gas. In cross-examination by CARC and Commission Counsel, the panel indicated that the in-house route selection process began in September of 1974 and was followed by field studies. Vol. 59 8454-8457
- The route was established mainly by Mr. Fawcett according to his testimony in cross-examination by Commission Counsel. The chronological steps leading to the present route were outlined as: (1) establishment of a 15 to 20 mile corridor from government maps in October of 1974, (2) identification of physical control points (lakes, rivers, etc.) within the corridor on the northern Vol. 59 8467-8470 8480-8481
- The route was established mainly by Mr. Fawcett according to his testimony in cross-examination by Commission Counsel. The chronological steps leading to the present route were outlined as: (1) establishment of a 15 to 20 mile corridor from government maps in October of 1974, (2) identification of physical control points (lakes, rivers, etc.) within the corridor on the northern Vol. 60 8485-8505

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REFERENCE

and southern 200 mile segments, (3) establishment of a narrower corridor between those control points, (4) overflight of the route, (5) development of more detailed maps and stereo-photo examination to define a 3 mile wide corridor, (6) Terrain typing of the corridor by Mr. Drew in January, (7) specific route selection within the corridor, (8) submission of the route to geotechnical consultants (Klohn Leonoff) and environmental consultants (Lombard North) and, (9) minor route adjustments based on consultants comments. Commission Counsel asked for the consultants reports that suggested route changes. It was pointed out that the route selected was done without vegetation and archaeological maps and with the only environmental maps used being the governments land use series.

a-2 Terrain Typing and Geotechnical

- The terrain typing work was described by Mr. Drew. Vol. 59
In addition to verification and revision of some 8362-8375
of Dr. Mallards work done for CAGPL, his work 8442-8453
produced an estimate of terrain sensitivities.
Field work is continuing to "polish up" the terrain
typing and some changes will be forthcoming. In Vol. 60
cross-examination by Commission Counsel, Mr. Drew 8536-8541
said although there was no field checking prior to
the application he had subsequently field checked
the entire route in the N.W.T. plus some of the
laterals. A second field trip is scheduled for
September. Mr. Mirosh said that the revised mosaics
would be ready in about 9 months. He added that Vol. 60
terrain typing was a preliminary indicator to be 8589-8590
followed up by geotechnical evaluations.
- The background of geotechnical work in the areas of Vol. 59
the Foothills route was given by Mr. Gillespie 8378-8389
along with two examples of route relocations for 8391-8392
geotechnical reasons - one at the Bear River
crossing and the other near Norman Wells. Drilling
on the southern 100 miles of the route was
undertaken prior to the application and subsequent
work will be reported soon. In response to
Commission Counsel's cross-examination, Mr. Gillespie Vol. 60
said that no soils map will be made. Drilling will 8560
be done on a site specific basis to confirm soil
conditions indicated by terrain typing.
- Geotechnical reconnaissance was done in January to Vol. 59
pinpoint river crossing areas for spring 8457-8466
investigations, according to Mr. Gillespie in
cross-examination by Arctic Gas. No qualified
hydrologist was on the reconnaissance crew but Unies
Ltd. was later engaged to study the hydraulic aspects.
The route change at the Bear River was because a
visual inspection showed slump blocks on the
original route. No drilling has confirmed this.
Mr. Drew said that his terrain typing didn't classify
this as an "old slope failure" because of the scale
of the work.
- Foothills plans to chill the gas as far as MP 688 Vol. 59
(station 14) which is just south of the Mackenzie 8399-8408
River near Fort Simpson, according to Mr. Mirosh
in cross-examination by Arctic Gas. Arctic Gas
pointed out that this was within the discontinuous
permafrost zone where the prime concern with a
chilled pipeline in unfrozen ground is frost heave.
Arctic Gas went on to suggest that in the Ebbit
Hills re-routing the Foothills line ran through
soils which were 30% frozen and 70% unfrozen while
the original Arctic Gas route went through terrain
that was 90% frozen. Mr. Mirosh indicated that
the geothermal problems of a warm gas pipeline
in permafrost were being investigated to satisfy

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REFERENCE

concerns about unchilled gas beyond station 14. It was his belief, however, that it was easier to handle thawing of permafrost than freezing of non-permafrost in this part of the discontinuous permafrost zone.

a-3 Ancillary Facilities

- The general location of wharves, stockpile sites and access roads will be finalized by ongoing field investigation, according to Fawcett. Two compressor stations (#6 and #8) were initially relocated for geotechnical and access reasons. This in turn resulted in the relocation of 17 other stations. Drilling for all ancillary sites will be done sometime in the future. Vol. 59
8349-8352
- Meetings have been held with NTCL, KAPS and DPW to discuss wharf sites and, in the case of DPW, the location of the pipeline relative to the highway, according to cross-examination by Arctic Gas and Commission Counsel. Wharf sites will be investigated by drilling and will be relocated if necessary. Engineering conflicts between the highway and the pipeline at River between Two Mountains, at Saline River and at Little Chicago were resolved by moving the pipeline or the highway. Foothills environmentalists had no comment on the Saline River relocation. Vol. 60
8567
- Final designs will be done after drilling is done this summer at the 8 or 10 major river crossings, according to Mr. Fawcett in cross-examination by Commission Counsel. The balance of the 32 river crossings are not considered major and will not present any serious geotechnical problems. Vol. 59
8352-8353
8466-8467
Vol. 60
8563-8566
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8567-8569

a-4 Community Laterals

- Air photos have been obtained for the laterals and field work is to begin this season to confirm and refine the route, according to Mr. Fawcett. In cross-examination by Commission Counsel, Mr. Fawcett said that the Yellowknife - Pine Point lateral would be suspended from four highway bridges. Meetings were held with DPW and they expressed no reservations on this proposal. Vol. 59
8340-8341
- The laterals were located in the same general way as was described for the main route, according to Mr. Fawcett in cross-examination by Commission Counsel. It was pointed out by Commission Counsel that the laterals represented more than half of the new route. Mr. Bouckhout said that no environmental review had been made yet. Mr. Gillespie said that no drilling had been done and none was planned. Mr. Drew said that no terrain typing had been done but it was planned. Commission Counsel observed that no one had even "set foot" on the laterals yet it represented about one third of the total pipeline route. The Judge said that it was important to know what had been done and if no one had set foot on the lateral routes it was important to know because this was a new area of impact. Mr. Mirosh responded by saying that route overflights had been done along with an investigation of the river crossings by car. Detailed field work is planned for September. Vol. 60
8569-8576
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8578

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REFERENCE

- It is imprudent to assert that a northern homeowner would save \$500.00 per year, according to Commission Counsel, when the costs are dependent on the routing and costs of construction of the laterals which are yet to be finalized. The panel suggested that the costing was based on a consultants opinions and that the conditions on the main laterals would not be that much different from northern Alberta. Vol. 60
8578

a-5 Miscellaneous

- The qualifications of Mr. Mirosh and Mr. Fawcett were questioned by Arctic Gas. Mr. Mirosh advised that he had no experience on pipeline routing. Mr. Fawcett advised that he had experience on routing of high voltage transmission lines and had worked for Union Gas in Ontario. Arctic Gas suggested that routing a pipeline was not analogous to routing a high voltage transmission line - Arctic Gas asked for a list of reports and studies upon which the panel relied (as required by the Judges rulings). Without this it was difficult for them to cross-examine. Foothills undertook to supply the list. Vol. 59
8389-8391
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8415-8425
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8392-8394

(B) Environmental

b-1 Routing - General

- The environmental input for the routing of the pipeline is not complete, according to Mr. Bouckhout Multi-disciplinary field work is now underway along the entire route. In response to Arctic Gas's questions, Mr. Bouckhout indicated that the 850 miles of "new line" (200 miles at both the north and south end of the main line in the N.W.T. plus 450 miles of laterals) was subjected to a literature review in May using available CAGPL, government and other information. Site specific information is now being assembled by a multi-disciplinary field crew. Vol. 59
8356-8358
Vol. 59
8432-8442
- The route was subjected to a corridor wide environmental review on a sectional basis when Mr. Bouckhout was an employee of Lombard North, according to cross-examination by Commission Counsel. The names of the people at Lombard North who did the work were listed by Mr. Bouckhout. He stated that no formal reports were issued but the environmental views were communicated directly to Mr. Ellwood at Foothills. Vol. 60
8505-8507
- A list of the route adjustments undertaken for environmental reasons was requested by Commission Counsel. Mr. Bouckhout indicated that a list of such recommendations was probably not available. A list of Lombard North's recommendations was requested. The re-routing around the Norman Range to avoid a peregrine falcon area and to avoid hydrological problems was cited as a example. Arctic Gas asked for the references leading to the statement that the route be 5 miles away from Travaillant Lake. Vol. 60
8507-8512
Vol. 59
8394-8398
- The environmental review process was outlined by Mr. Bouckhout for Commission Counsel. Initially the route was established by Mr. Fawcett with some input by Mr. Ellwood. That route was then commented on by the environmental group. Subsequently field work has been undertaken along the entire route by a multi-disciplinary team of Vol. 60
8514-8534

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REFERENCE

biologists and geotechnical and terrain analysis specialists. The names of the team were listed. Thus far two passes over the length of the main line have been made and a report on the findings will be published this fall. Not all the work will be completed until after the 1976 breakup but some of the areas that have been identified for possible changes are: (1) the west side of the Norman Range, (2) the crossing of Smith Creek near Wrigley and (3) the East Channel crossing area. A complete list of anticipated adjustments to the route was requested by Commission Counsel. The process of handling environmental input to the Foothills organization was described.

Vol. 59
8470-8472

b-2 IBP Sites

- The Foothills re-routing to avoid the Ebbuit Hills IBP Site was questioned by Arctic Gas by pointing out that the Firth River IBP site may be extended to take in the Arctic Gas pipeline right-of-way so that the impact can be assessed. Vol. 59
8398-8399
- The Foothills Yellowknife lateral as proposed crosses 3 IBP sites according to Commission Counsel. Mr. Bouckhout was aware of one at Hart Lake and advised that consultation with the University of Alberta, who operate the site, indicated that they were not opposed to the pipeline in that area. The large data base built up from the area could be used to assess the impact of the line. Vol. 60
8580-8588

b-3 Willowlake River

- The revised location of the Willowlake River crossing did not present any environmental and socio-economic concerns that the panel was aware of when questioned by Commission Counsel. Commission Counsel then pointed out that: (1) the pipeline and highway are 2,000 feet apart at that point, (2) Fort Alexander, an archaeological site, is between them, (3) historical grave sites are on that part of the route, (4) native people have a fishing spot near the crossing, (5) there is an important trapping area in the vicinity, and (6) a highway rest stop and recreation facilities are proposed nearby. Commission Counsel suggested that, in fact, the environmental assessment, apart from a broad analysis, is yet to be done. Vol. 60
8541-8556

b-4 Community Laterals

- Environmental studies on the laterals will be reported on this fall or winter, according to Mr. Bouckhout in cross-examination by Arctic Gas. Lombard North's staff who will be doing the work were listed. Vol. 59
8408-8415
Vol. 59
8358-8359

b-5 Miscellaneous

- Mr. Bouckhout said, in response to Arctic Gas's questioning, he had not done pipeline environmental work before he had done transportation corridor impact studies. Before joining Foothills in April he was employed by Lombard North as project manager on the Foothills work. Vol. 59
8429-8432

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REFERENCE

- Mr. Bouckhout listed the various environmental consultants being used by Foothills. Commission Counsel pointed out that no reports by these consultants were shown on the list of documents Foothills had said were in their possession. Vol. 60
8512

(c) Socio-Economic

c-1 Route - General

- The CAGPL routing near communities was deemed reasonable by Foothills until it could be shown otherwise, according to Mr. Fawcett in cross-examination by the N.W.T. Indian Brotherhood/Métis Association. The route may be changed at Fort Good Hope but this hasn't been carried forth yet. Vol. 59
8475-8478
- There has been no socio-economic input into the route location, according to Mr. Fawcett in cross-examination by Commission Counsel. In re-examination Mr. Fawcett indicated that the route had been influenced by trapping areas near Travaillant Lake and Fort Simpson and a compressor station had been moved away from Good Hope. Vol. 60
8534-8535
- The route adjacent to Travaillant Lake and South of the Mackenzie River avoids trap lines as identified on the government land use maps, according to Mr. Bouckhout in cross-examination by the N.W.T. Indian Brotherhood/Métis Association. Foothills would try to avoid areas of fur bearing animal concentration as much as possible. Vol. 60
8588-8589
- The route adjacent to Travaillant Lake and South of the Mackenzie River avoids trap lines as identified on the government land use maps, according to Mr. Bouckhout in cross-examination by the N.W.T. Indian Brotherhood/Métis Association. Foothills would try to avoid areas of fur bearing animal concentration as much as possible. Vol. 59
8472-8475

c-2 Transportation

- Foothills has not decided which of the existing transportation systems it will be using in the Delta area, according to Mr. Fawcett and Mr. Mirosh in cross-examination by ITC/COPE. ITC/COPE pointed out the concern the people of Tuktoyaktuk had about the use of barges on the Eskimo lakes. Vol. 59
8478-8480

(D) Miscellaneous

- The Judge ruled against the proposal by Foothills to present their evidence on "Canadian Natural Gas Requirements and Supply". Vol. 60
8482-8484
- The Judge indicated that he wanted to complete the Foothills Phase 1 evidence in the two weeks of hearings starting on September 15th. He also suggested combining Phases 2 and 3 to avoid duplicating evidence. Vol. 60
8591-8594

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUME No. 61)

FOOTHILLS PIPE LINES LTD. - HYDRAULICS AND
CONNECTING FACILITIES

YELLOWKNIFE, N.W.T.

SEPTEMBER 15, 1975

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TOPIC: Phase I: Engineering and Construction of the Proposed Pipeline

Panel of Foothills Pipelines on Hydraulics and Connecting Facilities

DATE: September 15, 1975 in Yellowknife

WITNESSES: Foothills Panel consisting of

- E.A. Mirosh: Manager, Engineering, Foothills Pipelines
- R.M. Lazerte: Supervisor, Compressor Station Design, Foothills Pipelines
- D. Hensch: Supervisor, Facilities Planning, Alberta Gas Trunk Line

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical Engineering

a-1 General

- The five main differences between the Arctic Gas and Foothills projects were described by Mr. Mirosh as: (1) Foothills has no Alaska lateral and sizes its pipeline at 42" compared to CAGPL's 48", (2) CAGPL proposes to use a .720" wall pipe at 1680 psi as opposed to Foothills 0.540" wall pipe operated at 1250 psi (and tested to 1440 psi), (3) Foothills will cease chilling south of Fort Simpson while CAGPL proposed to chill to the 60th parallel and from there to Zama Lake it will operate with a freeze thaw cycle, (4) Foothills will be an all-Canadian line building up to 2.4 billion cubic feet (bcf) per day over 5 years while CAGPL proposes to carry ultimately 2.25 bcf per day from each of the Prudhoe Bay and Mackenzie Beaufort areas and, (5) Foothills proposes to use 24,000 hp. units to drive the compressors while CAGPL proposes to use 30,000 hp. units.

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8625-8627

a-2 Pipeline Design

- The physical properties of the gas to be received by the pipeline were described by Mr. Lazerte. The two "non-standard" requirements for water vapour and heavy hydrocarbons are due to the unique pressures and temperatures of this pipeline.
- The hydraulic analysis procedure was described by Mr. Hensch. The throughput of 2.4 bcf was based on studies of Delta reserves and Canadian markets according to Mr. Mirosh. With this throughput a 42", 0.540" wall, 1,250 psi pipeline with 24,000 hp. compressing units spaced at 48 to 50 miles would result in minimum service costs. Mr. Lazerte explained how the build-up of gas was tied to reserves, deliverability and markets. He pointed

Vol. 61
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8627-8629

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8636-8642

a-2 Pipeline Design (Cont'd)TRANSCRIPT
REFERENCE

- out that in the first year all gas is assumed to come from Taglu and that equipment installation at compressor stations would be staged. In some cases chilling equipment would be installed ahead of the compression equipment. The entire Foothills system would tie into the Westcoast, AGTL and AGTL (Canada) systems as described by Mr. Mirosh.
- Vol. 61
8630-8631
- Many alternative pipe sizes and compressor station horsepowers were investigated before arriving at their proposal, according to Mr. Hensch. In cross-examination by Arctic Gas, Mr. Mirosh pointed out that the 1,250 psi pressure was chosen over 1,440 psi for metallurgical reasons and because it matched supply with market demand. The pressure could be increased to 1,440 psi if the increased volume of gas could be justified. The operation at 1,250 psi will give operating experience with a known pipeline in a unique permafrost condition before increasing to the unique 1,440 psi. Arctic Gas questioned whether pipe of the roughness indicated in Foothills throughput calculations was in fact available.
 - Vol. 61
8646-8648
 - Vol. 61
8657-8666
 - Vol. 61
8677-8681
 - The crack propagation problem was the principal reason for decreasing the operating pressure from 1,440 psi to 1,250 psi, according to Mr. Mirosh. In cross-examination by Arctic Gas Mr. Mirosh said that Foothills had done no studies on crack arrestors although some were planned.
 - Vol. 61
8629-8630
Vol. 61
8666-8669

a-3 Compressor Stations

- The operation of the aerial cooler at station 17 was described by Mr. Lazerte in cross-examination by Arctic Gas. Arctic Gas suggested that under certain ambient conditions the outlet temperature could exceed 80° which is deemed undesirable.
- Vol. 61
8669-8672
- The excess horsepower at station #1 is to account for fluctuations at the processing plant, according to Mr. Lazerte. This and the location of the station were questioned by Arctic Gas in cross-examination.
- Vol. 61
8633-8634
Vol. 61
8672-8676
- The 24,000 hp. units were chosen because they are available, proven and their size conforms to the temperature constraints of the pipeline, according to Mr. Lazerte. He disagreed with Arctic Gas' assertion that the capacity of the chillers cannot be increased to lower the gas discharge temperature much below 25°F because of surging and choking of propane flow. There is no provision for restrictions on the Foothills part of the system caused by compression failures on the southern part of the system (AGTL etc.)
- Vol. 61
8642-8643
Vol. 61
8687-8689
Vol. 61
8689-8691
- Foothills intends to operate at above 32°F south of Fort Simpson because of the decreasing amount of permafrost, according to Mr. Mirosh in cross-examination by Arctic Gas. Station 14 was a subject of interest to Arctic Gas. Mr. Mirosh explained that a gas heater at that station would keep the temperatures of the gas above freezing but its notation had been overlooked on the drawings. There would be a total of five such units operated as trim heaters.
- Vol. 61
8651-8657

TRANSCRIPT
REFERENCE

a-3 Compressor Stations (Cont'd)

- The effect of compressor or chilling unit outages was discussed by Mr. Hensch. In cross-examination by Arctic Gas Mr. Hensch explained that if a station chiller was 'out' the excess capacity of the upstream station would be relied on to make sure the gas temperature didn't exceed 32° after compression. Studies on the effects on the gas temperatures of the soil around the pipe under these conditions have not been done but Mr. Mirosh suggested that perhaps the problem could be minimized by cutting back the station horsepower.

Vol. 61
8648-8651
Vol. 61
8682-8687

a-4 Community Laterals

- The Yellowknife community lateral would operate at temperatures above 32°F but no studies have been prepared on the consequences according to Mr. Mirosh in cross-examination by Commission Counsel. It was pointed out that this lateral was a small diameter, low velocity line that wouldn't contain enough (temperature) energy to cause environmental disruption.

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8693-8697

a-5 Miscellaneous

- Items previously requested by the Inquiry were filed by Foothills: (1) the spare capacity in the AGTL system, (2) detail on the capital costs and the proportions of public financing for the Foothills project, (3) details on the costing of gas to northern communities, (4) charts on river crossings, (5) corridor composit maps and memorandum requested by Commission Counsel and, (6) reports by Klohn Leonoff on route adjustments.

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8614-8617

B. Environmental

b-1 Miscellaneous

- The location of denning areas near Travaillant Lake and Thunder River, reports relied on by environmental consultants, and the route adjustments recommended by those consultants were filed as exhibits with the Inquiry in accordance with previous requests.
- The location of International Biological Program (IBP) sites and grave sites referred to in the cross-examination of the 'Location' Panel by Commission Counsel was clarified by counsel for Foothills. The pipeline location does not conflict with grave sites and crosses only one of four IBP sites according to Foothills.

Vol. 61
8616-8618
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8618-8625

C. Socio-Economic

- nil

D. Miscellaneous

d-1 Statement by United Steelworkers of America

- The presentation of the Steelworkers was read by Mr. Len Stevens, area representative for the Prairie Provinces and NWT. The Steelworkers believe that any development must be part of a comprehensive

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8599-8614

d-1 Statement by United Steelworkers of America (Cont'd)TRANSCRIPT
REFERENCE

energy policy. They expressed concern about the staggering social costs for those excluded from the decision-making process. The special problems of the project were outlined as:

1. The disruption to the steel industries called on to produce the material for the project. The Canadian steel industry is not capable of producing the pipe, and employment generated by the project would be short-term.
2. The national economic ramifications of the project would be serious.
3. The environmental impact of the project is unclear. The cost of this damage would be born by the residents of the Territories and the Native people especially. It would be grossly unjust to decide on a pipeline before settlement of land claims.

The benefits of the pipeline would accrue to corporations in the form of higher profits while the costs accrue to other groups in society. Other options such as a railroad should be investigated in light of a national energy policy. The "energy crisis" blackmail should not be allowed to make people believe the pipeline is an all or nothing project.

Policy and Planning
ACND Division
October 20, 1975

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 61-A, 62)

FOOTHILLS PIPE LINES LTD. - PIPELINE DESIGN

YELLOWKNIFE, N.W.T.

SEPTEMBER 15 AND 16, 1975

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TOPIC: Phase 1: Engineering and Construction of the Proposed Pipeline

Panel of: Foothills Pipe Lines on Pipeline Design

DATE: September 15 and 16, 1975, in Yellowknife

WITNESSES: Foothills Panel consisting of:

E.A. Mirosh:	Manager, Engineering, Foothills Pipe Lines
A.F. Bauer:	Supervisor, Construction, Foothills Pipe Lines
G. Walker:	President, Canuck Engineering Limited
P.G. Glockner:	Consultant to Foothills Pipe Lines Ltd.

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 General

- The differences between the Foothills and Arctic Gas proposals, as outlined by Mr. Mirosh were: (1) Foothills proposes single major river crossings while CAGPL proposes dual crossings, (2) Foothills proposes a 60 ft. right-of-way with a 60 ft. construction strip while CAGPL proposes a 120 ft. right-of-way and (3) Foothills does not propose to use any intermediate block valves. Vol. 61-A 8700-8701
- The structural considerations involved in assessing the pipeline's integrity, as outlined by Dr. Glockner, are: (1) hoop stresses, (2) longitudinal stresses due to internal pressure, (3) longitudinal stresses due to temperature changes, (4) bending and deformation due to frost heave, (5) stresses due to settlement, (6) stresses at bends, (7) stresses in pipe surrounded by soils with zero shear stress (i.e. muskeg) and (8) stresses due to axial temperature gradients. Vol. 61-A 8729-8733
- The permafrost, extreme cold and frost heave are special considerations, according to Mr. Bauer. The pipe would be bent to suit the ditch contour. Detailed soils information would be used to assess bedding, padding and backfill requirements. Different ditch specifications would be made for the various conditions considering cross-drainage, erosion, revegetation and slope stability. Vol. 61-A 8712-8718

a-2 Right-of-Way

- The payment for land use would be limited to a 60 ft. right-of-way according to Mr. Mirosh in cross-examination by Arctic Gas. The 60 ft. working surface would be cleared except in a few locations. Vol. 62 8766-8767
- An additional 10 ft. would be required if looping occurred, according to Mr. Mirosh and Mr. Bauer in cross-examination by ITC/COPE. The code has inter-pipe distance requirements. Permafrost and frost bulb interaction would also have to be considered. Vol. 62 8789-8791
- The 60 ft. right-of-way would be owned by Foothills while the 60 ft. working surface would be leased for construction, according to Mr. Mirosh in cross-examination by the N.W.T. Indian Brotherhood/Métis Association. The operation and maintenance activities would be confined as much as possible to the 60 ft. right-of-way. Vol. 62 8823-8829
- A working zone up to 280 ft. wide would be required at about one dozen river crossings or where conventional heavy equipment is prohibited due to excessive grades etc. Vol. 62 8837-8844

TRANSCRIPT
REFERENCE

a-3 Ditching

- The ditch would be dug to certain specifications based on subsoil investigations and then the pre-bent pipe would be immediately installed, according to Mr. Bauer in cross-examination by Commission Counsel. Counsel asked for a prototype ditch specification. In re-examination, Mr. Walker pointed out that ditching following bending and welding is the same for both applicants in arctic construction.

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8859-8868

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8878-8879

a-4 Pipe Stresses

- Data from detailed field tests will be used in the assessment of pipe stresses, according to Dr. Glockner after describing the assumptions he made in his calculations which are deemed extremely conservative. Arctic Gas suggested that the criteria established by Dr. Glockner wouldn't be possible to achieve in the field. Mr. Mirosh said that he had not reviewed Dr. Glockner's work but he agreed with the approach. The stress analysis used an internal pressure of 1,250 psi. The 1440 pressure was not studied. There is no substantial difference in the approach to stress analysis between Arctic Gas and Foothills, according to Commission counsel's cross-examination of Dr. Glockner. A secure and safe pipeline can be built. It was emphasized that the assumptions presented in chief were not the limiting ones. In re-examination by Foothills and Arctic Gas it was explained that those assumptions were limited to the plastic range. Plastic deformation would permit much more displacement of the pipe before it failed.

Vol. 61-A
8733-8737

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8763-8766
8784-8786-d

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8786-h-8789

Vol. 62
8829-8837
- A report on crack arrestors will be available soon, according to cross-examination of Dr. Glockner by Arctic Gas. The work examines the stress concentrating effects of arrestors.

Vol. 62
8879-8887

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8786-d-8786-h

a-5 Frost Heave and Thaw Settlement

- Frost heave would be limited, according to Mr. Mirosh by: (1) soil replacement, (2) drainage of water, (3) insulation, (4) surcharge or deep burial, and (5) restraint.

Vol. 61-A
8701-8704
- The pipe stress theory related to frost heave was given by Dr. Glockner. The criteria used has not been applied to any operational pipeline according to Dr. Glockner in cross-examination by Arctic Gas.

Vol. 61-A
8737-8748
Vol. 61-A
8749-8755
- The Brooker mathematical model is being refined to account for the effects of water movement, according to Mr. Mirosh in cross-examination by Arctic Gas. A second model developed by Dr. Colter at RMC is being used as a check.

Vol. 62
8767-8771
- Three of the frost heave control measures proposed by Foothills were questioned by Arctic Gas: (1) the drainage of water was said to be impractical because it would be frozen, (2) insulation around the pipe was said to have little long-term effect and (3) the use of frost anchors was questioned. In cross-examination by Commission counsel, Mr. Mirosh said that the frost heave solutions had not yet been approved by the environmentalists because the designs were not done. This is also the case with the environmental effects of thaw settlement.

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8771-8773

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8844-8848

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8848-8854

TRANSCRIPT
REFERENCE

a-6 Above-Ground Piping

- Above-ground piping will occur on the Yellowknife - Pine Point lateral and at compressor stations, according to Mr. Mirosh. Overhead river crossings have not been discounted. In cross-examination by ITC/COPE, Mr. Mirosh said that the Yellowknife lateral pipe would be carried on existing bridges at Kakiska River and two other rivers. Vol. 61-A
8706-8709
- Engineering factors to be considered in above-ground river crossings are: (1) amount of earth moving on steep banks (2) bank erosion, (3) access and (4) disturbance, according to Mr. Walker's cross-examination by Commission counsel. Overhead crossings should be limited in the Arctic. Originally the Steep Creek crossing was considered as a potential overhead crossing but this has subsequently been changed. Vol. 62
8817-8819
- Engineering factors to be considered in above-ground river crossings are: (1) amount of earth moving on steep banks (2) bank erosion, (3) access and (4) disturbance, according to Mr. Walker's cross-examination by Commission counsel. Overhead crossings should be limited in the Arctic. Originally the Steep Creek crossing was considered as a potential overhead crossing but this has subsequently been changed. Vol. 62
8868-8873

a-7 River Crossings

- The design of river crossings was explained with examples by Mr. Walker in chief and in cross-examination by ITC/COPE. The Swimming Point crossing would be done from a pad on one bank. The pipe would be welded in sections as it is pulled into the channel trench. At Fort Simpson the crossing would have to be excavated in a combination dredging/dragline operation because of the cobbly nature of the soils. Smaller river crossings would be done from the ice in winter using side booms. Generally, single river crossings are favoured (over dual crossings such as proposed by CAGPL) since design can satisfy problems of pipe security without the cost of doubling the line. Vol. 61-A
8720-8727
- The hydrological and hydraulic data were obtained from Klohn Leonoff, Unies and the published data of CAGPL, according to Mr. Walker in cross-examination by Arctic Gas. The final river crossing design wouldn't be done until a permit is received according to Mr. Mirosh. Mr. Walker explained that the approach to the preliminary design was a function of the available data base and the philosophy of the design approach. Generally, a 'worst case' disturbance was taken such as at Swimming Point where the worst scour was assessed to be greater than that assumed by CAGPL. Vol. 62
8819-8823
- The hydrological and hydraulic data were obtained from Klohn Leonoff, Unies and the published data of CAGPL, according to Mr. Walker in cross-examination by Arctic Gas. The final river crossing design wouldn't be done until a permit is received according to Mr. Mirosh. Mr. Walker explained that the approach to the preliminary design was a function of the available data base and the philosophy of the design approach. Generally, a 'worst case' disturbance was taken such as at Swimming Point where the worst scour was assessed to be greater than that assumed by CAGPL. Vol. 62
8776-8784
- The single versus dual approach to major river crossings was discussed by Mr. Mirosh in cross-examination by Arctic Gas. Foothills approach was to be more conservative in the design of a single crossing by burying deeper etc. As an example, the Swimming Point crossing would be buried about 25 ft. below the river bed. Vol. 61-A
8755-8761
- The contingency plan for the failure of a single crossing was questioned by ITC/COPE. Mr. Mirosh explained that Foothills philosophy was that one pipe crossing designed properly was as good as two. If there was a failure, restoration would have to take place no matter what environmental conditions prevailed. It was pointed out that even with a dual crossing a failed section would have to be secured. These contingency plans were also the subject of cross-examination by Commission counsel. Mr. Mirosh indicated that temporary repairs could be made. No consultation had taken place with the environmental people in this problem. Vol. 62
8791-8794
- The contingency plan for the failure of a single crossing was questioned by ITC/COPE. Mr. Mirosh explained that Foothills philosophy was that one pipe crossing designed properly was as good as two. If there was a failure, restoration would have to take place no matter what environmental conditions prevailed. It was pointed out that even with a dual crossing a failed section would have to be secured. These contingency plans were also the subject of cross-examination by Commission counsel. Mr. Mirosh indicated that temporary repairs could be made. No consultation had taken place with the environmental people in this problem. Vol. 62
8873-8878

TRANSCRIPT
REFERENCE

a-8 Block Valves

- Intermediate block valves are not necessary because of the decreased risk of third party damage to the pipeline in the remote regions of the North, according to Mr. Mirosh. In cross-examination by Arctic Gas it was pointed out that the effort to maintain these remote valves and the cost (about one million dollars for each of the 17 valves that would be required) were considerations. This was reiterated in the cross-examination by ITC/COPE. They pointed out that perhaps the valves would be required if the pipeline is considered as part of a transportation corridor (roads, transmission lines, oil pipelines) and when the possibility of looping is considered. Mr. Mirosh said that the valves could be installed later if required. Vol. 61-A
8704-8706
- The elimination of the block valves doesn't propose much difference from CAGPL, according to Mr. Mirosh in cross-examination by Commission counsel, since the same amount of gas would be exposed in each case if a rupture were to occur. Generally, valves are to facilitate looping and do not change the safety of the line. This would decrease the duration of a gas escape in the event of a pipe failure. The decision to eliminate the intermediate block valves has not been specifically referred to the environmental and socio-economic consultants. Vol. 62
8773-8774

a-9 Miscellaneous

- The soils drill hole data was obtained from AGTL through its involvement in the CAGPL group, according to Mr. Mirosh in cross-examination by Arctic Gas. Vol. 62
8767
- Fifty percent of the line was assumed to require counterweights, according to Mr. Bauer in cross-examination by Arctic Gas. This was used in arriving at the construction plan and cost estimates. Vol. 62
8775-8776
- The Judge asked that the work done by Foothills relating to the possibility of transporting Alaska Gas be provided to the Inquiry. This arose during the cross-examination by ITC/COPE from questions relating to hydraulic studies of the cross delta route. Vol. 62
8794-8808
- The amount of flexibility in the location of compressor stations is governed by hydraulic considerations, dependent on station horsepower, and temperature variations in the line, according to Mr. Mirosh in cross-examination by ITC/COPE. For operation maintenance convenience the horsepower at each station should be kept the same. With the 24,000 h.p. units proposed, the stations could be moved about $\frac{1}{4}$ mile either way if environmental or social conditions dictated. The exact station locations won't be decided on until after final design. Vol. 62
8813-8817

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUME NO. 62)

FOOTHILLS PIPE LINES LTD. - COMMUNICATIONS

YELLOWKNIFE, N.W.T.

SEPTEMBER 16, 1975

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c-1 General	173

TOPIC: Phase 1: Engineering and Construction of the Proposed Pipeline.

Panel of Foothills Pipe Lines on Communications

DATE: September 16, 1975 in Yellowknife

WITNESSES: Foothills panel consisting of:

E.A. Mirosh: Manager, Engineering, Foothills Pipe Lines.
W.R. Scrimmes: Private Consultant.

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 General

- The main differences between the Foothills and Arctic Gas communications proposals were outlined by Mr. Mirosh as: (1) CAGPL proposes to lease channels from Telesat Canada while Foothills proposes to use existing CN facilities modified as required, (2) CAGPL proposes its operation center in Calgary, while Foothills proposes to use Yellowknife and (3) CAGPL requires two to three times the number of channels required by Foothills. Vol. 62
8888-8890
- CNT knows northern conditions and has an existing infrastructure adequate to meet the pipeline needs, according to Mr. Mirosh. A 300-voice channel micro-wave system will be completed by CN as far as Inuvik by 1976. This is sufficient for the needs of Foothills and others. In the event of damage to the system CN can route communications by 4 alternative routes as described by Mr. Mirosh. The compressor stations would be designed to operate within established limits on the last command received or, alternatively, could be manned. Vol. 62
8890-8893
- The use of Telesat by CAGPL has been indicated in recent newspaper reports, according to Mr. Scrimmes. This would duplicate facilities already available. Foothills would make limited use of portable satellite stations primarily during construction although they would be used to a limited extent during the operation stage. Vol. 62
8896-8898
- Arctic Gas would utilize CNT, AGTL, etc., as common carriers even if they did use the Telesat system, according to counsel for Arctic Gas. Vol. 62
8903-8904
- Foothills, as a separate company from AGTL or WestCoast requires its own control center in the N.W.T. despite the fact that its executive offices are in Calgary, according to cross-examination of Mr. Mirosh by Arctic Gas. Arctic Gas suggested this was an unnecessary duplication of facilities and questioned the choice of Yellowknife over places on the main line such as Fort Simpson. Mr. Mirosh explained the choice was made because of good communications, the size of the town of Yellowknife with its social amenities, and the fact that it is a government center. Vol. 62
8923-8926
- A maximum one-third of the CNT's 300 channels would be used by Foothills, according to Mr. Scrimmes. The 300 channel system could be expanded if necessary by installation of additional multiplex equipment. The operation of the pipeline requires four categories of service: (1) speech (2) telex (3) mobile radio and (4) data transmission. These were explained by Mr. Scrimmes. Vol. 62
8900-8902
8926-8929

TRANSCRIPT
REFERENCE

In cross-examination Arctic Gas pointed out that they would only use 300 channels or one-third of the 900 channels in the transponder it would lease from Telesat. Foothills would require a maximum of 100 channels in its proposal. Upon being read the previous evidence of Arctic Gas' communications witness, Mr. Scrimes said it was not clear what type of channels were being referred to when it was stated that a maximum of 66 channels would be required from Calgary to Fort Simpson. It was evident that Arctic Gas would require more channels because of the greater length of their pipeline (Prudhoe Bay to the 49th parallel) and the greater number of compressor stations.

Vol. 62
8936-8941

a-2 Security

- The safety of the satellite and the earth stations is of some concern, according to Mr. Scrimes. The life span of Aniks 1, 2 and 3 is 9 years which is less than half the life span of the pipeline. The launching of these satellites is dependent on the United States. Also, foreign surveillance of satellite communications has been reported and satellites could be shot down by a foreign power. A terrestrial system is as secure or more secure than a satellite system.
- The risks are the same for the earth stations and the micro-wave towers in each system, according to cross-examination of Mr. Scrimes by Arctic Gas. It was pointed out that duplicate earth stations would be required at each site to utilize Anik 3 which operates at a different frequency. The spacing of the existing micro-wave towers compares favourably with the compressor station intervals. Only 1 additional active and 2 additional passive stations would be required. If a main line repeater station is lost, the alternative micro-wave routings would permit operation of the stations on each side from both ends.
- There is a rumour that the U.S. military advised against the use of a satellite system on the Alyeska line for security reasons, according to Mr. Scrimes in cross-examination by Arctic Gas. Alyeska used a combination of micro-wave and satellite systems. Mr. Mirosh emphasized that the prime reason for utilizing a terrestrial micro-wave system over a satellite system was to avoid duplication of facilities rather than for security reasons.

Vol. 62
8898-8900

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8904-8910

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8910-8923

B. Environmental

nil

C. Socio-Economic

c-1 General

- The impact of the proposals on the other uses of telephone, radio and T.V. circuits was questioned by the Judge. Mr. Scrimes explained that the basic telephone system now existing has a capability far in excess of the needs of the north. Use by the pipeline company will lead to an upgrading of service and to lower service costs because of pipeline-related revenue. The CRTC, CBC and a few private companies provide for T.V. service through Aniks 1 and 2. This is the single thing Telesat can provide best. Most radio (CBC), except for local stations, is provided by satellite and is regulated by the CRTC. CNT provides the basic business and personal communications services.

Vol. 62
8929-8934

TRANSCRIPT
REFERENCE

- The expansion of service resulting from the use of CNT by Foothills would only benefit Trout Lake, according to Arctic Gas in cross-examination of Mr. Scrimmes. Vol. 62
8934-8936
- There will be some communications problems during the initial stages of construction, according to Mr. Scrimmes in cross-examination by the N.W.T. Indian Brotherhood/Métis Association, but these would be straightened out within a month or six weeks. Construction camp pay phone use will tax the system somewhat. Improvements such as direct long-distance dialing would be introduced. The communications problems that occurred in Alaska were described. Most of these problems arose because there was no system in existence (such as CNT) at the time work began. Vol. 62
8941-8947
- The common carrier would provide all the equipment, engineering and services directly related to the communications system, according to Mr. Scrimmes in cross-examination by ITC/COPE. The existing system has the necessary capability but not all the equipment is installed. The experts think that if Foothills took 100 channels, leaving 200 channels for other use, the system would provide adequate service. Temporary satellite communications could be used to relieve the load if necessary. The highest demand would occur during construction. Vol. 62
8947-8957
- Private subscribers probably wouldn't pay for the additional equipment required to expand the communications facilities, according to Mr. Scrimmes in cross-examination by Commission Counsel. The allocation of capital, maintenance and service costs would be a decision for the regulatory agency. Commission Counsel suggested this could be a part of the contract between CNT and Foothills. Mr. Scrimmes said he was not aware of any studies to predict the number of calls that might be made during construction. He pointed out that the number of pay phones provided would be negotiated by the Unions. Vol. 62
8958-8965

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUME NO. 63)

FOOTHILLS PIPE LINES LTD. - COMPRESSOR
STATION DESIGNYELLOWKNIFE, N.W.T.
SEPTEMBER 17, 1975

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TOPIC: Phase I: Engineering and Construction of the
Proposed Pipeline.

Panel of Foothills Pipe Lines Ltd. on Compressor
Station Design

DATE: September 17, 1965 in Yellowknife.

WITNESSES: Foothills panel consisting of:

E.A. Mirosh :	Manager, Engineering, Foothills Pipe Lines.
R.M. Lazerte:	Supervisor, Compressor Station Design, Foothills Pipe Lines.
P. Beer :	Senior Engineer, Foothills Pipe Lines.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Engineering/Technical

a-1 General

- | | |
|--|--|
| <ul style="list-style-type: none"> - The differences between the Foothills and Arctic Gas approach to compressor station design were outlined by Mr. Mirosh as: (1) CAGPL's site requirements are 25 acres for each of its 18 stations while Foothills requires only 11 acres, for its 17 stations, (2) CAGPL proposes to build two 6,000 ft. and six 2,400 ft. airstrips while Foothills plans on using helicopters, (3) CAGPL plans to install refrigeration units in the early years only where they have operational compressors while Foothills plans to install refrigeration ahead of compression at some intermediate sites to control gas temperatures, (4) CAGPL's gas temperatures will fluctuate above and below 32°F south of Fort Simpson while Foothills plans to maintain gas at above 32°F south of that point and, (5) CAGPL plans to ship 450 MMCFD in the first year over and above that which Foothills plans and deems necessary for the Canadian Market (800 MMCFD). Mr. Mirosh went on to describe how the system would be operated from the Yellowknife headquarters. The stations would be unmanned, self-sufficient, fail-safe and locally "smart". To decrease the likelihood of unscheduled shutdowns a 'Maintenance Information System' for the compressor stations would be developed to sound alarms if unexpected wear occurred at the stations. - The propane refrigeration process was described by Mr. Lazerte. - The type and size of the major rotating equipment used in the compressor stations was described by Mr. Beer. Of the 17 stations, the northernmost 13 would have compression with chilling, three would have compression only and the most southerly station would have compression with aerial cooling. | <p>Vol. 63
8970-8978</p> <p>Vol. 63
8986-8989</p> <p>Vol. 63
8992-9000</p> |
|--|--|

TRANSCRIPT
REFERENCE

a-2 Size of Station Area

- The area required for the stations was determined after investigating the AGTL stations in Alberta and the size and layout of the proposed equipment, helipads and sewage lagoon, according to Mr. Lazerte. Consideration was given to buildings' spacing for safety, compactness for minimum environmental disturbance, codes, personnel requirements, repair requirements, road network requirements, living areas remote from operating areas and cost. A typical layout was described with the aid of a slide. In cross-examination by Arctic Gas, Mr. Lazerte indicated that, if looping occurred, 3 additional acres would be required along with the appropriate amount of borrow material. The pads would be used to house both pipeline and compressor station construction crews. Mr. Mirosh said that there had been no environmental advice on the effects of later expanding of the site to permit looping.

Vol. 63
8978-8986

a-3 Access

- Access to stations would be by helicopter supplemented by fixed wing aircraft from lakes, etc., according to Mr. Mirosh in cross-examination by Arctic Gas. Environmental advice endorsed the fact that long airstrips wouldn't be built.

Vol. 63
9019-9021
- The stations would be manned in the first few years while they were being debugged and then the manpower would shift to maintenance jobs based in the communities, according to cross-examination of Mr. Mirosh by ITC/COPE. Nearly all AGTL's stations are unmanned. ITC/COPE questioned the relative impact of damage done by airstrip construction compared to damage caused by other access methods during planned and unplanned shutdowns. Mr. Mirosh explained that a combination of winter roads (which have been available down the valley in the past), large helicopters and existing airstrips, frozen lakes, etc., would be used. This was pursued in Commission Counsel's cross-examination. Details of the type and frequency of flights were requested as well as a list of the permanent and snow (winter) roads that would be used.

Vol. 63
9044-9049

a-4 Water, Sewage and Solid Waste

- Details of the water, sewage and solid waste facilities were pursued in cross-examination by ITC/COPE. Water sources adjacent to the station site would be used or water would be hauled. Sufficient water storage (1,000 barrels) would be provided at each station to last 28 men 10 days. No fire fighting water is planned. The panel was not certain of the public health ordinance requirements concerning the distance a lagoon must be from an occupied site. The suggestion was made by ITC/COPE that lagooning is not permitted in Alaska and package treatment plants are required. Foothills indicated its plans are not yet finalized. ITC/COPE referred the panel to a DOE report by Grainge on camp waste disposal. Solid wastes would be incinerated but no details are available on this yet. Similarly no final decision has been made on the disposal of pipeline condensates and other harmful substances such as toxic lubricants, etc.

Vol. 63
8989-8992
9033-9044

a-4 Water, Sewage and Solid Waste (Cont'd.)

- The stability of sewage lagoons on permafrost terrain was questioned by Commission Counsel. Mr. Lazerte pointed out that the lagoon was within the 5 foot pad and would be bermed. Insulation could be used if required or a treatment plant could be used. No conclusion has been reached on the best type of treatment plant. The disposal of lagoon effluents to swamplands is being investigated by consultants and the method shows some promise although it is not the intent at this time. The environmental people have not yet approved of this idea. Vol. 63
9082-9091
- The discussion on water and sewage was confined to the operation stage and not the construction stage, according to Mr. Mirosh in cross-examination by Commission Counsel. The construction aspects would be dealt with by a subsequent panel. Vol. 63
9082-9091

a-5 Noise

- The factors affecting the noise level at compressor stations were described by Mr. Beer. Generally the noise would be kept to 60 dBA at the fence line. In cross-examination by Arctic Gas, Mr. Beer said that surveys of plants in Alberta give a general indication that this objective is possible. Mr. Lazerte described the two detailed sound surveys conducted by Foothills. Vol. 63
9000-9007
- The noise-carrying effects of humidity, temperature, terrain type, surface cover (snow, water) were pursued in Commission Counsel's cross-examination. The nature of the noise emitted by a station during normal operation and blowdown was described with particular reference to stations #1 and CO4. Mr. Beer said that no specific studies had been done on the noise characteristics of each station. This would be done during final design. Commission Counsel pointed out that a U.S. study on Alaskan Arctic Gas' proposal suggests that the normal station noise would carry to a radius of 1.3 miles and blowdown noise would carry to a 15 mile radius. The panel suggested that this was without attenuation devices. Environmental people will be involved in identifying sound-sensitive wildlife and acceptable noise levels. Vol. 63
9091-9112

a-6 Emissions

- The emission standards for oxides of nitrogen, carbon monoxide, unburnt hydrocarbons and sulfur dioxide were described by Mr. Beer. Important considerations are; exhaust velocity, stack height and the permissible concentrations of each of the above emissions. The problem of ice fog, as recently identified in a U.S. report, is not considered to be a problem, according to Mr. Beer. Vol. 63
9007-9011
9032-9033
9112-9113

a-7 Miscellaneous

- The maintenance information system (see a-1 above) is being developed by AGTL to a further extent than is used elsewhere, according to Mr. Mirosh in cross-examination by Arctic Gas. Vol. 63
9024-9025
- No stress analysis relative to the anchoring or thermal aspects of the compressors and chillers has been done, according to Mr. Lazerte in cross-examination by Arctic Gas. Vol. 63
9026-9028

TRANSCRIPT
REFERENCE

a-6 Emissions (Cont'd.)

- The buildings for compressors, etc., would be steel frame structures prebuilt as much as possible, according to cross-examination of Mr. Lazerte by ITC/COPE. The involvement of local builders would depend on the nature of the contracts. Vol. 63
9049-9052
- The station area would be fenced with a chain link fence topped by four strands of barbed wire for security, according to Mr. Mirosh in cross-examination by ITC/COPE. Vol. 63
9053-9057

B. Environmental

Nil.

C. Socio-Economic

Nil.

D. Miscellaneous

d-1 General

- The timetable for the balance of the evidence in Phase I was given by Commission Counsel. It was suggested that the evidence relating to the route across the delta as well as to the impact of the gas plants and gathering lines on the delta would be heard in Inuvik in January. Correspondence received from the Minister of INA, referring the cross Delta information to the Inquiry, was read by the Judge. He indicated that he wanted to hear this and the producer companies' evidence before visiting the Delta communities in January and February. Vol. 63
8966-8970

Vol. 63
9071-9082

Policy and Planning
(ACND) Division

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 63 AND 64)

FOOTHILLS PIPE LINES LTD. - PIPE METALLURGY
YELLOWKNIFE, N.W.T.
SEPTEMBER 17 AND 18, 1975

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TOPIC: Phase I, Engineering and Construction

Panel of Foothills Pipe Lines on Pipe Metallurgy

DATE: September 17 and 18, 1975 in Yellowknife

WITNESSES: Foothills panel consisting of:

- Mr. D.H. Hushion: Executive Vice-President, Foothills Pipe Lines Ltd.
- Mr. J.B. Wetterberg: Manager, Materials Engineering, AGTL
- Mr. E. Shelton: Senior Engineer, AGTL
- Mr. B. Holtsbaum: Consultant to Foothills Pipe Lines

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 General

- The differences between the Foothills and Arctic Gas projects metallurgical considerations were described by Mr. Hushion as: (1) the CAGPL line is 42" in diameter and operates at 1,680 psi while Foothills is a 42" line operating at 1,250 psi, (2) all the Foothills pipe could be bought in Canada while CAGPL would have to buy pipe outside the country, (3) the Foothills system utilizes standard pipeline components while the CAGPL line would require special 1,680 psi, 48" components, and (4) Foothills would reduce its operating pressure from the 1,440 psi test level to 1,250 psi while CAGPL's operating pressure would require crack arrestors.

Vol. 63
9116-9121

a-2 Pipe Supply

- Steel ingot and pipemill capacity in Canada was described by Mr. Wetterberg. This showed that the Foothills project would not overburden Canadian pipemills. The only unique aspect is the length of the line. The pipe itself is similar to 250 miles of 42" pipe on the AGTL system which has provided 6 years of operating experience.
- Only one mill in Canada is capable of making pipe to the Arctic Gas specifications, according to Mr. Hushion in response to the Judge's questions. The CAGPL pipe is unique and has never before been used in Canada. AGTL tried to purchase some of this pipe but was unsuccessful. The Alyeska pipe was 100% Japanese but it would be better to use Canadian pipe on this project, according to Mr. Hushion. There is a problem with price fluctuations of offshore pipe depending on competition. The ranking of pipe manufacturers as prepared by Arctic Gas is not applicable to the Foothills 42" pipe, according to Mr. Shelton in cross-examination by ITC/COPE.

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9122-9132

Vol. 63
9177-9189

Vol. 64
9268-9271

a-2 Pipe Supply (Cont'd)TRANSCRIPT
REFERENCE

- The Canadian plate and pipemills were discussed by Mr. Wetterberg in cross-examination by Arctic Gas. Vol. 63
9193-9194

- Canadian pipe would be preferred over offshore pipe by Foothills even if it was significantly more expensive, according to Mr. Hushion. The cost difference would be offset by simplified logistics and the fact that it is in Canada's best interest to use Canadian pipe. Although there is always the potential of supply interruptions by strikes if the pipe all comes from Canadian mills, Mr. Hushion pointed out that AGTL hadn't had that problem in the past. Vol. 64
9228-9235

- The Arctic Gas 30, 36 and 42 inch pipe in its system would be available in Canada, according to Mr. Hushion in cross-examination by Arctic Gas. When AGTL approached Stelco to buy 48" pipe to suit the CAGPL specifications they were told that there were internal problems to be worked out and consequently the pipe was not available. Arctic Gas advised the Inquiry that a phone call to Stelco had confirmed that the CAGPL pipe could be made. Vol. 63
9171-9173
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9189-9190
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9225

a-3 Pipe Metallurgy

- The metallurgical consideration of the 42", 0.540 wall grade 70 Foothills pipe was outlined by Mr. Hushion. Most significantly, to minimize the risk of longitudinal ductile fracture, the operating pressure would be reduced from the allowable 1440 psi to 1250 psi. The effectiveness of crack arrestors has not been conclusively proven to Foothills. Of particular concern is the stress concentrating characteristics of the arrestors. Arctic Gas, in cross-examination, pointed out that the 42" El Paso line arrived at the use of crack arrestors independently and U.S. Steel also had favourable results with crack arrestors. Although El Paso operates at 1,620 psi, Arctic Gas pointed out the pressure isn't as important as the per cent of yield strength developed. El Paso utilizes 72%, Foothills uses 69%. Arctic Gas also questioned the applicability to the Foothills pipe of the Battele hypothesis developed for the Arctic Gas pipe. Mr. Hushion said that the Foothills pipe was capable of operating at 1,440 psi according to the Battele hypothesis but it would be operated at 1,250 psi. After examining the Battele report, Mr. Wetterberg said that the hypothesis did apply to the Foothills pipe. Arctic Gas filed as an exhibit a letter from Battele stating that there were too many unknowns to use the hypothesis on the Foothills pipe without verification. In cross-examination by Commission Counsel, Mr. Hushion explained that the Arctic Gas pipe was not more susceptible to fracture than the Foothills line but once the crack started the problem of stopping it was greater. Although the code permits operation at 80% of yield stress, Foothills would operate at only 69% because of caution and because that pressure suits the supply-demand forecast. Mr. Hushion went on to Vol. 63
9115-9116
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9265-9268

TRANSCRIPT
REFERENCEa-3 Pipe Metallurgy (Cont'd)

describe the type of 42" pipe on the AGTL system. He admitted that no Canadian pipeline company has had experience with the exact kind of pipe Foothills plans to use but Foothills "jump into the unknown" would be very much shorter than CAGPL's. In subsequent re-examination by Arctic Gas, Mr. Hushion agreed that the critical defect size before fracture propagation can occur is 6 inches.

- The causes and historical frequency of leaks and ruptures on pipelines was outlined by Mr. Shelton. In cross-examination by Arctic Gas, Mr. Shelton agreed that the likely incidence of rupture on modern large diameter pipelines was markedly less than the tabulated statistics would indicate. He agreed with Arctic Gas' statistics that indicated one failure every 9.5 years. Vol. 63
9133-9140
Vol. 63
9201-9206

a-4 Welding

- The weldability of the pipe is a function of the chemical composition of the pipe and all welds would be radiographed then subjected to hydrostatic tests, according to Mr. Shelton. Vol. 63
9144-9145
- Automatic welding would be used wherever possible, according to Mr. Hushion in cross-examination by the Indian Brotherhood/Métis Association. The number of welders would not be changed by the use of machines but there would be a shift from highly skilled welders to more easily trained technicians. Vol. 64
9226-9228

a-5 Corrosion

- There is a danger of corrosion if water gets between a crack arrestor and the pipe, according to Mr. Holtsbaum in chief and in cross-examination by Arctic Gas. This type of corrosion is hard to detect and is not susceptible to cathodic protection measures. Vol. 64
9213-9215
9150-9153
- Corrosion control must consider corrosion in three environments, which are, according to Mr. Holtsbaum, (1) Atmospheric corrosion, (2) Corrosion on the soil side of the pipe and (3) Internal corrosion. He went on to describe cathodic protection measures. Vol. 63
9147-9150
- There has been no decision made on which coating to use on the pipe to prevent atmospheric corrosion, according to Mr. Holtsbaum in cross-examination by ITC/COPE. Special steps would be taken on the Delta portions where the ocean air would accelerate corrosion. Vol. 64
9235-9241
- There is no apparent difference in the approach to corrosion between Foothills and Arctic Gas, according to Mr. Holtsbaum in cross-examination by Commission Counsel. Cathodic protection will be used throughout the length of the pipeline. The problem in frozen ground would be to impress the current into the ground. There is no experience on a long line in permafrost with which one can assess the problem. Vol. 64
9242-9251

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 64 AND 65)

FOOTHILLS PIPE LINES LTD. - GEOTECHNICAL CONSIDERATIONS

YELLOWKNIFE, N.W.T.

SEPTEMBER 18 AND 19, 1975

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TOPIC: Phase I: Engineering and Construction of the Proposed Pipeline.

Panel of Foothills Pipelines on Geotechnical Considerations

DATE: September 18 and 19, 1975 in Yellowknife.

WITNESSES: Foothills panel consisting of:

E.A. Mirosh:	Manager, Engineering, Foothills Pipe Lines
Dr. F.C. Yip:	Supervisor of Geothermal, Geotechnical and Hydrological Evaluations, Foothills Pipe Lines Ltd.
D.M. Davidson:	Director of Engineering, Klohn Leonoff Consultants Ltd.
F.B. Claridge:	Executive Engineer, Klohn Leonoff Consultants Ltd.
G. Spafford:	Director of Engineering, Unies Ltd.
Dr. C.T. Hwang:	Consultant (Geothermal) to Foothills Pipe Lines Ltd.

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Engineering/Technical

a-1 General

- It is possible to build a safe and environmentally acceptable pipeline in the Mackenzie Valley, according to the panel in cross-examination by Arctic Gas. Vol. 65 9488-9490
- Foothills work is not behind that of Arctic Gas, according to the panel in cross-examination by Commission Counsel. Vol. 65 9502-9509
In response to questions by the Judge, Mr. Mirosh said Foothills would be in a position to hire Arctic Gas' consultants if Foothills were successful in obtaining pipeline approval.
- Reservations on Arctic Gas' approach, conclusions and solutions were outlined by the panel in cross-examination by Commission Counsel. Mr. Claridge said Arctic Gas seemed bogged down in office-oriented paperwork and the application of much of their theory has not been demonstrated for this pipeline. Foothills work has been more field-oriented. Dr. Hwang said he agreed basically with Arctic Gas' analysis but Foothills had a better understanding of the geothermal input data. This may or may not be significant in the final analysis. Mr. Spafford pointed out that his work had been to search out basic field data, and both companies' river crossing designs are preliminary. Hydrologically they are similar. Vol. 65 9509-9521

a-2 Frost Heave and Thaw Settlements

- Geothermal disturbance and the objects of the geothermal analysis were outlined by Drs. Yip and Hwang. The analysis is based on a computer simulation which incorporates unique features such as: (1) freezing front suction pressure, (2) variations of frost front pressure, (3) freezing rate, (4) soil consolidation, and (5) two dimensional seepage flow around the pipe. A heave profile chart for the route is planned. Arctic Gas suggested that the moisture migration and consolidation aspects of the Foothills simulation work were in fact similar to those of Arctic Gas' advisor Sluzerchuck and consultant Battelle. Dr. Hwang pointed out that the simulation program had not been modified much. Input data had been improved by a literature search. Vol. 64 9277-9282 9314-9316 9349-9350
Vol. 64 9340-9342 9360-9362 9319-9327

TRANSCRIPT
REFERENCE

- The difference was that one company took the finite element approach while the other chose the finite difference approach. Dr. Hwang said he would be presenting a paper on these differences.
- The worst frost heave would be in a silty material with a water table available, according to Dr. Hwang in cross-examination by Commission Counsel. The 'worst case' heave hasn't yet been worked out but this must be done before one can evaluate the solutions to be applied. Vol. 65
9536-9543
 - The worst case for thaw settlement depends on ice content and compressability of the soil, according to cross-examination of the panel by Commission Counsel. The magnitude of such a worst case hasn't been calculated yet. This must be known to evaluate solution effectiveness. Remedial measures contemplated include soil replacement, alternative types of construction and drainage. The applicability of these measures is being done through the work of Dr. Glockner (on stresses) and Dr. Hwang (on geothermal simulation) and will be ready for the NEB hearings.
 - The choice of the southern limit for chilling the gas was questioned by Commission Counsel. Dr. Hwang said that the choice would depend on soil data and the considerations of potential thaw settlement and frost heave. Mr. Claridge said that a mile-by-mile soils investigation would have to be done before a southern limit to chilling could be established. Routing changes and construction procedures could handle some of the problems. The best judgement of Kohn Leonoff is that chilling should stop at the Mackenzie River. Vol. 65
9521-9536
 - The routing around the Ebbutt Hills was questioned by Arctic Gas. Mr. Claridge said that the route was presented to him but he concurred with it. If frost heave were a problem, chilling could be stopped north of the region. Vol. 64
9395-9400

a-3 Drainage and Erosion

- Airphoto interpretation was used to give preliminary information on drainage, erosion and areas requiring buoyancy control, according to Mr. Davidson in cross-examination by Arctic Gas. Field studies are underway to examine sheet flow and to establish methods for treating drainage according to Mr. Claridge. It was his view that active layer flow was less than one percent of the total runoff. Mr. Spafford said he had no estimate of the permeability necessary to have subsurface flow prevent frost bulb formation. Mr. Claridge outlined some of the surface sealant methods that might be used to prevent erosion. Vol. 64
9354-9359
- Six field sites were selected to study erosion and drainage control, according to Mr. Spafford and Mr. Davidson in cross-examination by Commission Counsel. Site work was done in late May and June and included: (1) evaluation of active layer thickness, (2) slope measurement, (3) active layer permeability tests and (4) drainage courses were identified and the amount of flow measured. This information will be used by multi-disciplinary groups to develop drainage and erosion design methods. Based on the spring runoff condition, it is believed that the active layer flow is small compared to the total flow. This may vary through the year. Vol. 64
9394-9395
- Mound breaks are believed to be the best way to handle surface drainage, according to Mr. Claridge in cross-examination by Commission Counsel. Dr. Hwang said that the effect of frost heave and thaw settlement at these breaks had not been investigated yet. The mound breaks would be about 8 or more feet wide and would be typically spaced at a minimum of 40 or 50 feet and a maximum of 300 feet. On steep slopes special protection devices such as stilling basins, let-down structures and baffles would be used. Special erosion protection safeguards which include construction procedures will be given to the Inquiry when the NEB makes the information public. Vol. 65
9549-9554
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9555-9567
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9567-9586

TRANSCRIPT
REFERENCE

a-4 Slopes

- Slope stability studies were conducted in an area within five miles of the proposed route, according to Mr. Claridge. In cross-examination by Arctic Gas, he indicated that the January and spring reconnaissance trips resulted in re-routing of the pipeline around failed slopes. These were described previously by the location panel. A steepness criteria was not used in classifying slopes. The object was to cross the minimum slope possible and to do slope comparisons only by region. Arctic Gas asked that a list of the route changes recommended by Klohn Leonoff be provided to the Inquiry. In cross-examination by ITC/COPE, Mr. Claridge said that a third reconnaissance trip was now underway and after that trip a report could be issued. Although the work has been underway less than a year, Mr. Claridge said there would be time to refine work before a right-of-way is granted. Vol. 64
9290-9298
Vol. 64
9366-9372
Vol. 64
9375-9385
- Slope failure solutions were discussed by Mr. Mirosh and Mr. Claridge in cross-examination by ITC/COPE. If failures occurred after construction, use would be made of stabilization materials stockpiled at certain areas along the route. Full consideration would be given to environmental and aesthetic concerns. Re-vegetation, mulching and sprayed on asphalt compounds would be used. ITC/COPE pointed to right-of-way re-vegetation problems in Alaska caused by large chunks of frozen material left after excavation. Vol. 64
9404-9406
- Site specific consideration would be given to the stabilization of slopes, according to Mr. Claridge in cross-examination by Arctic Gas. Some cuts would be required but they would be such as would maintain an adequate factor of safety under static and dynamic (seismic) loading conditions. The seismic risk on the route is small. Detailed work is yet to be done. Vol. 65
9454-9461
- The soil pore pressure development due to thawing of ice and the related migration of water is not well understood, according to Mr. Claridge in cross-examination by Arctic Gas. The theory has not been proven. Although the soil permeability is a key parameter other factors such as pore pressure, cohesion, friction angle, unit weight, thermal coefficient and thermal conductivity are important. The coefficient of consolidation C_v (which expresses the rate of pore pressure dissipation) was not used because it can't be adequately determined in practice - particularly in permafrost terrain. Mr. Claridge said he doubted its practical value. Instead, Foothills emphasis is placed on observations of pore pressure and field observations. Relying on C_v could lead one to believe a slope would fail at a lower angle than it actually does. In re-examination, Mr. Claridge said he had examined the Arctic Gas reports related to the C_v as requested. He was critical of the conclusions and the field techniques used to support the theory. Vol. 64
9437-9451
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9452-9454
Vol. 65
9588-9592

a-5 Rivers

- Estimates of streamflow, sedimentation, scour and runoff are conservative according to Mr. Spafford. This is necessary because of the lack of data. Mr. Claridge said that the information was developed on a regional basis covering an area within about 5 miles of the pipeline. In cross-examination by ITC/COPE, Mr. Spafford said that Unies did no field work but relied on weather data and the few existing streamflow records. One winter season's observations give some idea of what streams do flow in the winter but further work is required to improve the data base. Vol. 64
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9364-9366
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9434-9436

TRANSCRIPT
REFERENCE

- Scour calculations are based on limited data and are for preliminary design only, according to Mr. Spafford. More data is required for the extreme case, particularly on the Mackenzie. In cross-examination by Arctic Gas, Mr. Spafford said he found the Blench method of scour calculation difficult to apply to the east channel situation. Mr. Mirosh explained that Foothills proposed to bury the Mackenzie River crossings deeper than Arctic Gas. The scour depth was estimated at 15 ft. and they would bury the pipe at 25 feet. Arctic Gas pointed out that Foothills showed its east channel crossing where Unies had said to allow 20 to 25 feet for scour. After examining drawings Mr. Mirosh said there was an error on the alignment sheet in the application and the Foothills crossing should be located at the same place as Arctic Gas' but buried 5 feet deeper (i.e. 25 ft.). Arctic Gas suggested that scour at hanging ice dams would be a problem on the route. Vol. 64
9307-9311
 - Borrow material would not be removed from small streams but it may be from the mouth of some rivers, according to Mr. Mirosh and Mr. Spafford in cross-examination by ITC/COPE. Vol. 65
9480-9482
 - The selection and revision of the Great Bear, Swimming Point and Steep Creek river crossings were described by Mr. Claridge and Mr. Mirosh in cross-examination by Arctic Gas. The winter construction method of crossing small streams was described by Messrs. Spafford and Mirosh in cross-examination by ITC/COPE. Siltation was a prime concern along with the maintenance of winter flow by use of culverts. The danger of icings was discussed by Mr. Spafford. One solution suggested was to bury the pipe deeper. Dr. Hwang said this problem will be investigated on the geothermal model within a month or so. Vol. 64
9419-9423
9432-9434
Vol. 64
9372-9375
Vol. 64
9414-9419
9426-9427
Vol. 64
9428-9432
- a-6 Miscellaneous
- The historical involvement of the various consultants and individuals, their qualifications and role in the geotechnical process were described in chief and in cross-examination by the witnesses. Vol. 64
9273-9274
9282-9288
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9334-9340
9350
9362-9363
Vol. 65
9461-9462
9491-9494
9494-9502
 - The final location of compressor stations depends on further field investigation, according to Mr. Mirosh in cross-examination by Arctic Gas. Arctic Gas suggested that the present locations are based only on office hydraulic studies since on this basis the spacing works out correctly to the second decimal place. Vol. 64
9327-9334
 - Foothills has done some hydraulic studies on the cross Delta route, according to Dr. Yip and Mr. Mirosh in cross-examination by Arctic Gas. No geotechnical work has been done. Vol. 64
9342-9347
Vol. 65
9588
 - Geotechnical field work on the Pine Point and Yellowknife Community laterals is currently underway, according to Mr. Mirosh in cross-examination by Commission Counsel. It is too early to say how differential settlement problems will be settled. Vol. 65
9586-9587
 - Transportation of gas from possible sources on Banks and Victoria Islands has been discussed only in very general non-pipeline terms, according to Mr. Mirosh in response to the Judge's questions. Vol. 64
9347-9349

TRANSCRIPT
REFERENCEB. Environmental

Nil

C. Socio-Economic

Nil

D. Miscellaneous

- The provision by Foothills of changes under active consideration as they become apparent was the subject of a discussion between Counsel. It was agreed that relevant information would be provided.

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9385-9382

Policy and Planning (ACND)
Division.
October 23, 1975.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 65, 66, 67)

FOOTHILLS PIPE LINES LIMITED - CONSTRUCTION
YELLOWKNIFE, N.W.T.SEPTEMBER 19, 22 AND 23, 1975

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TOPIC: Phase I, Engineering and Construction of the Proposed Pipeline
Panel of Foothills Pipe Lines on Construction

DATE: September 19, 22 and 23, 1975 in Yellowknife

WITNESSES: Foothills panel consisting of:

- Mr. E.A. Mirosh: Manager, Engineering, Foothills Pipe Lines Ltd.
- Mr. A.F. Bauer: Supervisor, Construction and Planning, Foothills Pipe Lines Ltd.
- Mr. W. Kosten: Consultant to Foothills Pipe Lines Ltd.
- Mr. P. Jarvis: Consultant (UNIES Ltd.) to Foothills Pipe Lines Ltd.

HIGHLIGHTS

TRANSCRIPT REFERENCE

A. Engineering/Technical

a-1 General

- The differences in construction between the Arctic Gas and Foothills projects were described by Mr. Mirosh as: (1) CAGPL proposes a 48" thick wall pipe incorporating crack arrestors to be installed at an average rate of 75 miles per spread, per season; Foothills proposes a 42" thinner wall pipe to be installed at an average rate of 55 miles per spread season. Foothills feels that CAGPL has overestimated the spread productivity; (2) CAGPL will require 1.3 million tons of material in the north while Foothills will require just over one million tons and, (3) CAGPL will build 8 permanent airstrips while Foothills would rely on helicopters and won't build airstrips.

Vol. 65
9595-9600

a-2 Schedule

- The proposed schedule was described by Mr. Kosten. He had advised Foothills on costs and scheduling after consultation with a pipeline contractor. In cross-examination, Arctic Gas sought clarification of the construction schedule chart contained in the Foothills application. The entire right-of-way would be cleared ahead of the pipeline work except for the sensitive permafrost areas. In the example cited, no pipe laying would begin until January. The main reason that the southern spreads productivity was assessed at 75 miles/season while in the north it was 50 miles/season was the difference in temperature and day light during the winter construction period. It was deemed too dangerous for the men to work under artificial lighting. Near Inuvik work would occur from the end of January to late April. No work would be done in November and December because the work could be done by starting after the New Year.

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9723-9726

a-2 Schedule (Cont'd)

TRANSCRIPT
REFERENCE

- The Judge asked that the assertion by Foothills that CAGPL had overestimated spread productivity be examined further. Mr. Mirosh explained that because of darkness, the undesirability of lighting the right-of-way and the decision not to use snow making equipment, Foothills proposed to start later than CAGPL. Statistics presented by Mr. Jarvis indicated that on the average snow roads could not be used for hauling before mid December when there is almost total darkness. If artificial snow methods were used the date could be pushed back to mid November. Arctic Gas informed the Judge that is what they intended to do. Vol. 66
9726-9737

- Trenching and pipe laying would occur on February first near Inuvik and the last week in January near Fort Norman according to Mr. Kosten in cross-examination by Arctic Gas. This work would be done during daylight hours only. Vol. 66
9765-9771

- Construction work would be halted when the temperature went below about 35° below zero. Examination of weather records for this occurrence led to allowances for non-productive days according to Mr. Kosten in cross-examination by ITC/COPE. This allowance amounts to about 20 to 25% of the construction time. Vol. 66
9784-9790

- The possibility of extending or compressing the proposed construction schedule was explored by the NWT Indian Brotherhood/Métis Association in cross-examination of Messrs. Mirosh and Kosten. The only practical flexibility is in the construction of compressor stations if gas is required by 1980 rather than by 1982. Mr. Mirosh said that the construction could be extended to three years rather than two if the southern gas demand would permit it. Vol. 67
9876-9881

- There would be four construction seasons, according to Mr. Mirosh in cross-examination by Commission Counsel. The first season would involve clearing; the second season would involve mainline construction; the third season would involve mainline and lateral construction; the fourth season would complete lateral construction. In addition, spread six (which is in the Wrigley area) is being considered as a summer operation. This would allow more flexibility in the winter construction schedule, permit greater productivity on that spread and level out the employment permitting more training for northerners. Other summer work would be associated with stockpiling equipment and materials, opening of some borrow pits, fabrication of concrete weights (perhaps), restoration and revegetation, compressor station work and work on the two major river crossings (Mackenzie). Vol. 66
9908-9912

Vol. 67
9962-9967

- Foothills schedule shows that their project can be built without much leeway and this led them to the conclusion that Arctic Gas couldn't build theirs in their time frame, according to Mr. Bauer in cross-examination by Arctic Gas. Vol. 67
9912-9929

TRANSCRIPT
REFERENCEa-2 Schedule (Cont'd)

The critical considerations are temperature and daylight. Commission Counsel pointed out that Foothills spread #1 would be required to build 45 mainline miles plus 16 miles of the Parson's Lake feeder lateral in one season for a total of about 60 miles. This is equivalent to Arctic Gas' proposed production which Foothills said was not possible. Mr. Mirosh suggested that some of the work on the Parson's Lake lateral could be done by the Producers. Commission Counsel suggested that this was a mistake in the application and challenged the panel to admit it.

a-3 Manpower

- The manpower aspects of the project were described by Mr. Kosten. Arctic Gas had Mr. Kosten explain parts of the manpower chart in the application. Apparent discrepancies between the maximum number of workers (700) and maximum camp size (500) were explained by Messrs. Kosten and Mirosh who said that some spreads may work out of two camps 50 miles apart.

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9651-9655
9670-9674

a-4 Logistics

- A general description of the project staging and barging plans was given by Mr. Mirosh. In cross-examination by Commission Counsel, Mr. Mirosh said that staging sites are considered at Axe Point, Dory Point and Poplar Landing. An all-weather road would be required to Axe Point as part of the pipeline project. Staging at Fort Simpson is also being considered. The Axe Point site would give spring barging a lead time of 2 to 2½ weeks over Hay River and would relieve the strain on the facilities there. Mr. Mirosh also explained Foothills contingency plan to bring fuel to the project by a 35,000 ton tanker through Bering Strait to Tuk. From Tuk, the fuel would be barged up-river as far as Fort Good Hope.
- The tonnage figures quoted for the Foothills project (see a-1 above) did not include the 32,000 tons and 3,200 tons necessary for the Yellowknife/Pine Point and other community laterals respectively, according to Mr. Mirosh in cross-examination by Commission Counsel. Assuming no spare capacity in the existing barging operations, 8 tugs and 48 barges would be required. River dredging is not assumed. Ownership of the added equipment has not been decided. Some barges would be beached and bermed to act as fuel storage tanks.
- A critical path analysis is under development by Foothills staff and a planning consultant, according to Mr. Mirosh in cross-examination by Commission Counsel. The Delta Producers requirements are not being incorporated into the analysis except with respect to target dates.

Vol. 65
9600-9604

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9917-9920

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9996-9998
10004-10014

Vol. 67
10020-10022

a-5 AccessTRANSCRIPT
REFERENCE

- Foothills plans to upgrade existing wharf facilities and provide temporary wharf facilities were described by Mr. Mirosh. In cross-examination by Commission Counsel, Mr. Mirosh said that existing community wharves would be upgraded and used if that was acceptable to the local people, otherwise Foothills would build its own. Portable wharves would be floated to some sites and sunk into place. During the winter they would be hauled up on shore.

Vol. 65
9604-9605

Vol. 67
10022-10024
- Two heavy lift S61 type helicopters and one small helicopter would be required per spread, according to Mr. Mirosh in cross-examination by Arctic Gas. Each machine would operate 16 hours a day. Arctic Gas pointed out that helicopters couldn't operate under icing conditions because the build-up of ice would unbalance the rotors. Although heliport beacons would be installed, Arctic Gas indicated that helicopters couldn't fly under certain IFR conditions. Mr. Mirosh pointed out that use would be made of the winter road which has been in the valley for the past 5 years and helicopters would supplement this facility.

Vol. 66
9743-9746
9834-9835
- The existing airstrips at Wrigley, Fort Good Hope and Norman Wells would be used, according to Mr. Mirosh in cross-examination by Commission Counsel. This would be supplemented by flights from abandoned airstrips, CNT airstrips and various lakes. Commission Counsel asked that these be identified.

Vol. 67
10024
- The Mackenzie Valley Highway would be used to the fullest extent possible, according to Mr. Mirosh in cross-examination by Commission Counsel.

Vol. 67
9989-9991
- The existing winter road would be used in places where it is near the right-of-way, according to Mr. Mirosh in cross-examination by Arctic Gas. Mr. Bauer said that some gravel roads might be built within the right-of-way.

Vol. 66
9682-9687
- The existing winter road would be used extensively during the early phases of the project to supplement helicopter transportation, according to Mr. Mirosh in cross-examination by Commission Counsel. Commission Counsel pointed out that the winter road is not there. It was built to Inuvik in 1970, was found to be uneconomic and hasn't been built since. Mr. Mirosh suggested that operation of such a road is a function of the tonnage put on it and if Foothills needed it, it would be there.

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9982-9987

a-6 Snow Roads

- Snow road construction was described by Mr. Jarvis with the aid of graphs showing snowfall accumulation records and spread snow road construction schedules based on climatic criteria..

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9629-9636

a-6 Snow Roads (Cont'd)

TRANSCRIPT
REFERENCE

- Arctic Gas requested a copy of the snow road report due for release at the end of the month. Mr. Jarvis explained that his graph took no account of snow-making equipment. After having the charts explained, Arctic Gas pointed out that the snow roads could be used as they are built rather than waiting for 100% completion.

Vol. 66
9703-9714
- Snow road construction could start in late October if snow-making equipment were used, according to Mr. Jarvis in cross-examination by Arctic Gas. Mr. Kosten agreed that if this were done there would be no reason why pipeline construction couldn't start immediately there after. November would bring good weather for pipeline work. Mr. Jarvis pointed out the ground must be frozen prior to placing a snow road. Thus 550 to 750 degree days below 32°F would be required before construction could begin. Arctic Gas said that their Inuvik test snow road was built in October using a pulvimaxer. After reading the Inuvik snow road report, Mr. Jarvis pointed out that, in fact, that road wasn't built until early December because of a lack of snow. At that time the active layer was completely frozen. Thirty inches of roadbed should be in place before hauling starts and this requires about 2,000 degree days. Therefore, he would not recommend that work start before the end of November. Arctic Gas suggested that earlier dates could be achieved by use of LGP vehicles. It was also pointed out by Arctic Gas that the active layer under the Inuvik test road was frozen two weeks earlier than the surrounding ground because of the preparatory work done to the surface.

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Vol. 67
10031-10035
- Harvesting snow would be confined to lakes which froze to the bottom or to the fully frozen edges of other lakes, according to Mr. Jarvis in cross-examination by ITC/COPE. Information on these lakes has not yet been gathered. When the snow road starts to deteriorate its use would be restricted and/or snow-making equipment would be brought in. When the road starts to rut seriously, hauling would stop.

Vol. 66
9818-9832
- Snow roads were proposed on the Alyeska project but were not implemented, according to EPB's cross-examination of Mr. Jarvis. If snow is to be made, the environmental effects should be demonstrated. In all his experience, Mr. Jarvis said that the degree days have governed snow road closure not snow melt. In any event, closure is a subjective decision made by the land use authorities. The EPB emphasized the importance of everyone understanding the criteria under which the snow roads would be shut down since that is the key to the whole operation.

Vol. 67
9855-9859

Vol. 67
9860-9872

a-6 Snow Roads (Cont'd)TRANSCRIPT
REFERENCE

- The impact of a snow road being used in the same location over three or four successive seasons should be minimal if it is properly used and maintained, according to cross-examination of Mr. Jarvis by Commission Counsel. Vol. 67
9987-9989
- Ice bridges would be made using snow-making equipment rather than by flooding in order to get a more uniform build-up, according to Mr. Jarvis in cross-examination by ITC/COPE. Vol. 66
9832-9834
- The EPB pointed out that for environmental reasons, these bridges should be ripped out in the spring rather than left to melt out. Vol. 67
9859-9860

a-7 Clearing

- Clearing operations were described in general by Mr. Bauer. In cross-examination by Arctic Gas, Mr. Mirosh explained that eight crews would clear two spreads each to complete clearing in one year. Arctic Gas sought explanations for apparent discrepancies between the Foothills comments on the Pipeline Application Assessment group questions and Foothills manpower schedule contained in their application. Mr. Mirosh explained that the one season clearing operation would reduce the manpower peaks by extending the job. It would also reduce congestion during construction. It was pointed out that clearing would not be done on sensitive terrain until just before the construction. The Judge asked that this be noted for the terms and conditions. Vol. 65
9606
9609-9611
Vol. 66
9699-9700
9746-9752
- Woodchippers would be used in the clearing operation wherever possible, according to cross-examination of Mr. Bauer by the EPB. Burning would be used as a last resort. The EPB expressed concern about the environmental considerations incorporated in these decisions. Vol. 66
9674-9682
- Woodchippers would be used in the clearing operation wherever possible, according to cross-examination of Mr. Bauer by the EPB. Burning would be used as a last resort. The EPB expressed concern about the environmental considerations incorporated in these decisions. Vol. 67
9839-9842
- Half the cleared right-of-way would be exposed over two summers, according to Mr. Bauer in cross-examination by Commission Counsel. There is no impact report on this. This differs from Arctic Gas who say they will clear just ahead of construction. Mr. Bauer corrected his evidence in chief to say that Foothills would use hand clearing not only where there was marketable timber but also in places where there would be adverse environmental consequences as a result of machine clearing. A consultant will be preparing a report comparing the environmental consequences of machine versus hand clearing. Grubbing would be done as part of the clearing operation. Vol. 67
9929-9943

a-8 Grading

- The grading of the right-of-way and of side slopes was described by Mr. Bauer. Vol. 65
9606-9612
- Grading of side hills in sensitive permafrost areas would not be done ahead of construction, according to Mr. Mirosh in cross-examination by the EPB. The EPB pointed out that much of the route north of Norman Wells was sensitive permafrost. About 200 miles of the route can be classified as sensitive permafrost. Granular Vol. 67
9844-9855

TRANSCRIPT
REFERENCE

a-8 Grading (Cont'd)

material and fabric mats would be used to stabilize deteriorating areas. The EPB asked for the conditions under which different techniques would be used. Mr. Mirosh said this would come after a permit was issued. The EPB questioned how an impact statement could be made if it wasn't known how the project was going to be built.

- The practice of mounding snow over the ditch line is to prevent frost penetration, according to Mr. Bauer in cross-examination by Commission Counsel. Commission Counsel pointed out that the area would be frozen solid anyway because of permafrost. Mr. Kosten agreed that such a practice would serve no purpose in permafrost areas. The cutting of side hills was pursued by Commission Counsel in questioning of Mr. Bauer. A 4 degree slope would not require cutting. Mr. Bauer said that further geotechnical work was required before the number of sidehill cut miles could be given. Cuts would be stabilized after construction and any fill hauled to establish a working surface would be left in place.

Vol. 67
9943-9958
Vol. 67
10025-10026

a-9 Trenching and Blasting

- The ditching operation was described in Chief by Mr. Bauer.
- The ditch would be left open for the least time possible, according to Mr. Kosten in cross-examination by ITC/COPE. The spoil replaced in the trench would be fine enough to permit revegetation.
- A modified blasting technique which incorporates a smaller unit charge would be required on half of the line, according to Mr. Kosten in cross-examination by Arctic Gas. Further testing of the blasting technique is planned for this winter or next, according to Mr. Mirosh in cross-examination by the NWT Brotherhood/Métis Association.
- If the pipeline is looped a prudent interpipeline distance for blasting in permafrost would be 15 to 20 feet, according to Mr. Kosten in cross-examination by Commission Counsel. Looping would require an additional ten to twenty feet of right-of-way.

Vol. 65
9607-9608
9623-9624
Vol. 66
9779-9784

Vol. 66
9755-9763
Vol. 67
9900-9901

Vol. 67
9959-9960

a-10 Bending

- Bending was described in Chief by Mr. Bauer. Preheating for bending might be required under certain temperatures on this project, according to Mr. Kosten in cross-examination by Arctic Gas.

Vol. 65
9607
Vol. 66
9752-9755

a-11 Borrow

- No gravel requirements have been included in the tabulations for right-of-way requirements apart from that required for bedding, padding and backfill, according to Mr. Mirosh in cross-examination by Arctic Gas. Of particular interest to Arctic Gas are the requirements for right-of-way levelling and access and the apparent discrepancy in the evidence on borrow requirements for side slopes.

Vol. 66
9687-9699
Vol. 66
9775-9776

a-11 Borrow (Cont'd)TRANSCRIPT
REFERENCE

Mr. Mirosh said that this would be determined in the future. Since the exact location of blasting is not known, the location of backfill borrow areas hasn't been determined. A similar situation exists for the location of aggregate for concrete weights used for buoyancy control.

Vol. 66
9771-9775

- Foothills has a general idea of where it will get its granular material but further subsoil investigations are required, according to Mr. Bauer in cross-examination by the EPB.

Vol. 67
9842-9843

a-12 Pressure Testing

- Both water-methanol and warm water hydrostatic testing would be used, according to Mr. Mirosh in cross-examination by Commission Counsel. The methanol solution would be distilled to a $\frac{1}{2}$ per cent solution and discharged into water courses by dilution. Consideration is also being given to storing the methanol after the test to use it as a fuel or ship it back to the south on the empty barges. Methanol disposal will be dealt with by the environmental panel.

Vol. 67
9972-9976

a-13 Miscellaneous

- The total energy balance between that required to build the project and that provided by the project was questioned by ITC/COPE. Mr. Mirosh indicated that to his recollection the energy would be 'repaid' within the first few months or year of the projects operation.
- The details of how two spreads would tie in the pipe was requested by Commission Counsel.
- Double jointing would not be required because the 42" pipe would come from the mills in 70 foot lengths, according to cross-examination of Mr. Mirosh by Commission Counsel.

Vol. 66
9777-9779

Vol. 67
9960-9962

Vol. 67
9976-9977

B. Environmentalb-1 Environmental Education and Enforcement

- The number, qualifications, location and powers of environmental inspectors was pursued with Mr. Mirosh in cross-examination by Commission Counsel. In re-examination Mr. Mirosh said that each spread would have 3 inspectors of various disciplines and each of the three districts would have a chief environmental inspector. There would also be a floating group of five specialists. The Head office would have 4 to 7 specialists as well for a total of 30 to 50 inspectors. The senior inspector at each spread would have 'limited duration' shut down powers to be backed up by the district chief inspector's power.

Vol. 67
9991-9996

Vol. 67
10028-10031

b-2 Restoration and Revegetation

- Revegetation would start in May or June following construction by seeding and fertilizing from a helicopter, according to Mr. Mirosh in cross-examination by Commission Counsel to have the revegetation details provided.

Vol. 67
9977-9980

TRANSCRIPT
REFERENCE

b-3 Environmental Proof

- The burden of proof on environmental and socio-economic implications of the project should be on the applicant, according to cross-examination by the EPB. The Judge asked that counsel give some thought to this. Is the burden of proof on the applicants before the Inquiry? This will be a matter of some importance later in the Inquiry when arguments on terms and conditions may depend on the state of the applicant's evidence. Vol. 67
9872-9876

b-4 Miscellaneous

- Problems encountered with drainage at construction pads on the Alyeska project were not known to the panel when asked during cross-examination by Commission Counsel. Vol. 67
9967-9968
- A separate sewage lagoon for the construction manpower peaks would be 700 ft. by 100 ft. built adjacent to the pad in the area reserved for looping expansion, according to Mr. Mirosch in cross-examination by Commission Counsel. Package treatment plants are being considered. A consultant's (AESL) report on sewage and solid waste is due soon. Vol. 67
9968-9971
- The internal bending mandrels could lead to the deposition of hydraulic oils inside the pipe, according to Commission Counsel's cross-examination of Mr. Kosten. Vol. 67
9971-9972

C. Socio-Economic

c-1 Training and Employment

- Training, such as equipment operator training, during the advance clearing stage is being contemplated, according to Mr. Mirosch in cross-examination by ITC/COPE. A copy of Foothill's plans in this regard was requested by ITC/COPE. Vol. 66
9798-9800
- Skilled operators with many years hard construction experience will be required for most of the jobs directly related to pipe installation, according to Mr. Kosten in response to the Judge's questions. Not many of these people would be available in the north. Truck drivers, clearing and clean up operators could be northern trainees. Vol. 66
9809-9817
- If the construction period were extended to three years the manpower peaks would be smaller, according to cross-examination of Mr. Mirosch by the NWT Indian Brotherhood/Métis Association. Vol. 67
9900
- The maximum number of people north of 60° on the Arctic Gas project would be about 6,000, according to Arctic Gas in response to a previous request for clarification by the Judge. Vol. 67
10003-10004

c-2 Hours, Wages and Incentives

- The men would work 10 to 12 hours per day (including travel time), seven days a week, according to Mr. Kosten in cross-examination by ITC/COPE. The requirements of the NWT labour ordinance were not known to the panel. Vol. 66
9835-9837

c-2 Hours, Wages and Incentives (Cont'd)TRANSCRIPT
REFERENCE

- The wages and incentives for pipeline work in the NWT are already part of union agreements, according to cross-examination of Mr. Kosten by ITC/COPE and the NWT Indian Brotherhood/Métis Association. The influx of workers to a project is due to the expectation of high pay for unskilled labour. The wages are often not higher than elsewhere but working long hours with overtime drives the size of paychecks up. Mr. Bauer cited his experience in Europe where overtime was controlled in an attempt to modify the impact of the project. This resulted in project stagnation because the skilled labour was attracted elsewhere. Eventually the time limitations were dropped.

Vol. 66
 9800-9809
 Vol. 67
 9881-9899
- The possibility of decreasing the high wages on the pipeline by limiting overtime was explored by Commission Counsel in cross-examination of Mr. Kosten. Highly skilled labour can only be attracted by high remuneration. Swing shifts for semi and unskilled labour, although theoretically possible are not deemed practical.

Vol. 67
 9901-9908
- The collective agreements that exist with pipeline trade unions have a no strike clause, according to Mr. Kosten in cross-examination by Commission Counsel.

Vol. 67
 10025

D. Miscellaneous

- The Judge outlined the schedule for the completion of Phase I of the hearings.

Vol. 67
 9999-10003

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUME NO. 68)

FOOTHILLS PIPE LINES LTD. - OPERATIONS
AND MAINTENANCEYELLOWKNIFE, N.W.T.
SEPTEMBER 24, 1975

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TOPIC: Phase 1: Engineering and Construction of the
Proposed Pipeline

Panel of Foothills Pipelines on Operations and
Maintenance.

DATE: September 24, 1975 in Yellowknife.

WITNESSES: Foothills panel consisting of:

D.H. Hushion : Executive Vice-President, Foothills
Pipelines.

E.A. Mirosh : Manager, Engineering, Foothills
Pipelines.

R. Littledale: Manager, Process and Construction,
Westcoast Transmission Co.

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Engineering/Technical

a-1 General

- The main differences between Arctic Gas and Foothills operation and maintenance plan were described by Mr. Mirosh as: (1) Foothills would have its administration and gas control centers in Yellowknife while CAGPL would locate in Calgary, (2) Foothills would have its supply and maintenance depot in Fort Simpson while CAGPL's would be located in the south, (3) Foothills would have environmental staff at each district office, (4) Foothills project is on a smaller scale requiring 600 acres as opposed to CAGPL's 6,000, and (5) Foothills would increase gas throughput more gradually than CAGPL. Vol. 68
10040-10046

- The pipeline operation south of Fort Simpson to Zama Lake would be similar to that of existing pipelines, according to Mr. Hushion in cross-examination by Arctic Gas. Arctic Gas pointed out that when the number of miles of community laterals on the Foothills system are considered they have more pipe miles in the north than Arctic Gas. In the first operating years chilling facilities would be installed ahead of compression according to Mr. Mirosh. Arctic Gas suggested this would limit flexibility to make changes based on initial operating experience. Vol. 68
10047-10049

- Foothills would be laying more pipe and would require more miles of right-of-way when the laterals are considered, according to Commission Counsel in cross-examination. The acreage comparison given by Mr. Hushion in chief (see a-1 above) isn't meaningful because it didn't include Foothills use of borrow pits, shoo-fly roads, wharf areas, staging areas, etc. Vol. 68
10053-10054

- Westcoast probably uses block valves (Foothills doesn't plan to install them) to facilitate looping, according to Mr. Mirosh in cross-examination by Commission Counsel. Vol. 68
10058-10061

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10084-10093

- Westcoast probably uses block valves (Foothills doesn't plan to install them) to facilitate looping, according to Mr. Mirosh in cross-examination by Commission Counsel. Vol. 68
10083-10084

TRANSCRIPT
REFERENCE

a-2 Access

- Ground transport would be the primary mode of transport supplemented by helicopters, according to Mr. Hushion in cross-examination by Arctic Gas. Arctic Gas pointed out helicopters couldn't use slings under IFR conditions and helicopter IFR facilities would require a manned ground station. The right-of-way would be used if the Mackenzie Highway construction didn't progress as far as required. Vol. 68
10054-10058
- The reliance on a highway with helicopter support during operations was questioned by Commission Counsel. The snow road would be relied on in the winter, according to Mr. Mirosh. In the summer helicopters would be used along with the LGP vehicles using the right-of-way. Commission Counsel suggested that, in fact, the completion of the Mackenzie Valley Highway was counted on in Foothills first line plans. In response to the Judge's questions, Mr. Hushion said that if the highway were completed it would save Foothills \$22 million. Vol. 68
10093-10095
10098-10105
- The continuing need during operation stages for wharves and barges was questioned by Commission Counsel. Mr. Mirosh said that the tonnages involved would be insignificant compared to those shipped during construction. Mr. Hushion said that winter roads would be used. There are no present plans to use the Nelson-Fort Simpson winter road. Vol. 68
10109-10113
- The supply depot was located at Fort Simpson because of its accessibility by highway, according to Mr. Hushion in cross-examination by the N.W.T. Indian Brotherhood/Métis Association. Vol. 68
10061-10064

a-3 Station Operations

- There is no significant difference between the Foothills and CAGPL, startup, monitoring, closure and abandonment plans, according to Mr. Hushion in cross-examination by Commission Counsel. Both companies' plans were developed by the same person. Vol. 68
10095-10097
- The time required after startup before the stations would be unmanned would vary, according to Mr. Hushion in cross-examination by Commission Counsel. Once they are unmanned they would be visited daily or several times per week. Vol. 68
10115-10119
- No special security measures such as guard dogs, (as are used on Westcoast's aerial river crossings) are contemplated, according to Mr. Mirosh in cross-examination by Commission Counsel. Vol. 68
10113-10114

B. Environmental

b-1 General

- Foothills accepts the long term responsibility for right-of-way maintenance, monitoring and rehabilitation, according to Mr. Hushion in cross-examination by Commission Counsel. Environmental inspectors would be located at Yellowknife and each of the three district headquarters (Inuvik, Norman Wells and Fort Simpson). They would have access to other specialists on staff or to consultants. Vol. 68
10097-10098
Vol. 68
10106-10108

TRANSCRIPT
REFERENCE

b-1 General (Cont'd.)

- The weed and vegetation control chemicals are a site specific problem that hasn't been evaluated yet, according to Mr. Hushion in cross-examination by Commission Counsel. Vol. 68
10108-10109

C. Socio-Economic

c-1 Operations Center

- The operations center is located in Yellowknife to keep it as close as possible to the system and to keep the project self-contained in the N.W.T., according to cross-examination of Mr. Hushion by Arctic Gas. Vol. 68
10049-10053
- Fifty-six jobs in Yellowknife would be provided by the fifth year of operation, according to Mr. Hushion in cross-examination by ITC/COPE. Yellowknife was chosen because of the amenities it offers. The three district centers would be awkward to run using people living in nearby communities. Vol. 68
10064-10067
Vol. 68
10072-10073
- The size and social amenities offered by Yellowknife were the principal reasons for its choice, according to Mr. Mirosh in cross-examination by Commission Counsel. No studies or discussions on housing availability etc. have been initiated.

c-2 Personnel

- The unique nature of the industry in the north will require unique policies on counselling, training, etc., according to Messrs. Hushion and Mirosh in cross-examination by ITC/COPE. Northern trainees from the Nortran program have proven to be excellent technicians on the AGTL system. Union assistance and understanding will be required for skilled people without papers. The Unions haven't been approached yet. Vol. 68
10067-10072
Vol. 68
10074-10082
- The Nortran program is quite successful compared to other training programs, according to Mr. Hushion. The Foothills socio-economic group will be looking at the training programs of others such as the construction and mining industries to assess how a better success record can be achieved. Vol. 68
10123-10124

c-3 Health Services

- Foothills will work with the appropriate authorities to minimize the impact on health services, according to Mr. Hushion in cross-examination with ITC/COPE. Vol. 68
10073-10074

D. Miscellaneous

- The Judge asked Commission Counsel to look into the Foothills proposal to bring fuel into the project using a 35,000 ton tanker coming into Tuktoyaktuk harbour via the Bering Strait (see Construction Plan summary) Vol. 68
10124-10128

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUME NO. 69)

COMMISSION COUNSEL WITNESS

DR. P. WILLIAMS-GEOTECHNICAL FROST HEAVE

YELLOWKNIFE, N.W.T.

SEPTEMBER 25, 1975.

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TOPIC: Phase I: Engineering and Construction of the Proposed Pipeline.

Geotechnical - Frost Heave

DATE: September 25, 1975 in Yellowknife.

WITNESS: Commission Counsel's witness:

Dr. P. Williams: Professor, Geotechnical Science Program,
Carleton University.

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 Permeability and Water Movement

- Water moves to the freezing front (frost bulb around the chilled pipeline) from below, the sides and the top, according to Professor Williams. Even assuming no immigration of water the 10% expansion of in situ water in a 30 foot diameter frost bulb could cause a significant heave. Vol. 69
10253-10256
- The rates of water movement in frozen soils have been reported in the journals and studies described by Professor Williams in cross-examination by Foothills and Arctic Gas. Permeability shows a significant drop between 32 and 30.9°F after which the curves flatten out. Vol. 69
10270-10274
10361-10369

a-2 Frost Heave

- The frost heave phenomenon, with particular reference to the nature of the forces which pull water toward the freezing area, was described by Professor Williams. Not all the water turns to ice as the soil freezes which leads to a variety of "shut-off" pressures depending on the rate and duration of freezing. Although it is difficult to predict what the required shut off pressures will be in a particular case, Professor Williams' view was that they are much greater than those predicted by Arctic Gas. The heave that would require the greatest shut off pressure would occur below 32°F in fine grained soils containing water remaining unfrozen below freezing temperatures. Vol. 69
10234-10251
- The relevance of Hoekstra's experiment which Professor Williams used to demonstrate the possible magnitude of the cut off pressures, was questioned by Foothills in cross-examination because the temperature difference across the experimental samples would not occur in nature. This is not significant to the results, according to Professor Williams. NES (Northern Engineering Services) has taken a narrow and strictly empirical view which has underestimated the shut off pressures by 4 or 5 times or more. This was questioned further in Arctic Gas's cross-examination. Professor Williams pointed out that the NES experiments themselves have not demonstrated that they have been successful in stopping heave. Because of its short duration, their experiment did not account for long-term effects. They weren't able to accurately measure Vol. 69
10274-10284
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10294-10317

TRANSCRIPT
REFERENCE

- the short term heave. Dr. Sluserchuck of NES maintained that their approach was conservative. Professor Williams pointed out that they had not considered the established theory that has been published along with the field observations and experiments of others. Over the 50-year life of the pipeline, the pulling forces would get greater and greater leading to higher and higher shut off pressures. This results from the freezing of water behind the frost front. Shut off pressures will be very much greater than NES has predicted and the heave preventative measures proposed by Arctic Gas will not be sufficient. The theoretical maximum shut off pressure would be 100 x 2,000 pounds per square foot (psf). A feasible value of 120,000 psf has been demonstrated experimentally as opposed to the 3,000 psi anticipated by the NES work.
- The short-comings of the Arctic Gas approach, as summarized by the Judge, are: (1) their work is empirical not accounting for the theoretical work that has been done over the last 10 years, and (2) the experiments (a) didn't account for the freezing of the unfrozen water behind the frost front (b) didn't have the accuracy to measure the heave over the time of the test and (c) didn't account for the increase of cut off pressure with time.

Vol. 69
10317-10338

Vol. 69
10339-10351

Vol. 69
10351-10353

a-3 River Crossings

- The shut off pressure is potentially so great that it isn't feasible to try to attain it by deeper burial under a river, and berming wouldn't be possible, according to Professor Williams in cross-examination by Arctic Gas. There may be other solutions such as tunnelling, encasing the pipe in concrete or anchoring the pipe to the bed rock. In places the shut off pressure would be greater than a 100 foot high berm equivalent. Foothills proposal to bury as far as 30 feet under the Mackenzie wouldn't be very helpful.

Vol. 69
10354-10360

Vol. 69
10370-10372
Vol. 69
10284-10368

a-4 Pipe Considerations

- The potential problems associated with a chilled pipeline in unfrozen ground would be greater than for a warm pipeline in frozen ground, according to Professor Williams. The decision to switch from a chilled to a non-chilled mode would require an intimate knowledge of the ground conditions and would be a function of the maximum shut off pressure.
- Differential heave limits would depend on soil-pipe interaction and in particular, on the properties of the pipe, according to Professor Williams in cross-examination by Foothills and Arctic Gas. Professor Williams added that these considerations were beyond his expertise but the heave would be non-uniform over the length of the pipe.

Vol. 69
10266-10268

Vol. 69
10353-10354
10288-10293

Vol. 69
10251-10253

a-5 Active Layer

- The heaving of the ground above the pipe depends to a large extent on the existence of an active layer and the nature of the ground surface cover, according to Professor Williams in cross-examination by Arctic Gas.

Vol. 69
10284-10288
10369-10370

TRANSCRIPT
REFERENCE

a-6 Miscellaneous

- The Judge questioned Professor Williams on his frostheave Vol. 69 related work in Norway and at the Scott Polar Research Institute where he is now on sabatical. 10372-10375

Policy and Planning (ACND)
Division,
October 21, 1975.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 69 AND 70)

COMMISSION COUNSEL WITNESS
DR. E.B. OWEN-POINTED MOUNTAIN GAS PIPELINEYELLOWKNIFE, N.W.T.
SEPTEMBER 25 AND 26, 1975.

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TOPIC: Phase 1, Engineering and Construction of the Proposed Pipeline

Pointed Mountain Gas Pipeline

DATE: September 25 and 26, 1975 in Yellowknife.

WITNESS: Commission Counsel witness

E.B. Owen: Geological Survey of Canada.

TRANSCRIPT
REFERENCE

HIGHLIGHTS

A. Technical/Engineering

a-1 General

- A general description of the Pointed Mountain Pipeline was given by Mr. Owen emphasizing the topography, soils, permafrost and the gas gathering system. Vol. 69 10380-10385 10403-10404

a-2 Permit

- An indenture type of agreement with the Federal Government was entered into by West Coast when they built the Pointed Mountain line, according to cross-examination of Mr. Owen by ITC/COPE. West Coast put up \$500,000 to ensure performance. In Mr. Owen's opinion this should not be refunded. ITC/COPE asked that the permit be filed as an exhibit. Vol. 69 10454-10458 10493-10494
- The line was built under a lease subject to an annual rental which may not make it subject to land use regulations, according to Mr. Owen in re-examination by Commission Counsel. Vol. 70 10532

a-3 Pipe Installation

- The clearing, grading, hauling and stringing of pipe, the pipe bending, trenching, backfilling and cleanup were described by Mr. Owen. Vol. 69 10385-10388 10391-10392
- The pipe was welded and bent before the trench was dug although the permit indicated that the pipe should conform to the trench bottom, according to Mr. Owen in cross-examination by ITC/COPE. Generally the company did a very good job. The pipe was off the bottom of the trench in only one or two places. In the beginning of the work the inspectors were not prepared for permafrost. The subsidence of the trench backfill occurred in almost all areas but this could have been avoided by a larger berm over the pipe. Vol. 69 10467-10470 10480-10483
- The differences between the Pointed Mountain line and the proposed Mackenzie Valley line were emphasized by Foothills in cross-examination of Mr. Owen. The Pointed Mountain line is a hot gas line. They did not use snow roads in construction. The melting out of permafrost leading to surface ponding was to be expected. The bending of the pipe prior to ditching was contrary to the contract between West Coast and its pipeline contractor and was of no consequence to DIAND or the permit. Vol. 70 10507-10508 10520-10523 10525

TRANSCRIPT
REFERENCE

a-4 Pipe Weighting

- The use and installation of pipe weights was described by Mr. Owen. In cross-examination by ITC/COPE Mr. Owen reiterated his criticism of the installation of the saddle weights pointing out that they were not centered on pipe. This problem could be overcome by using bolt weights. Vol. 69 10388-10390 Vol. 69 10470-10477
- The substandard concrete weights that Mr. Owen noted on the project were in fact rejected by West Coast inspectors, according to cross-examination by Foothills. Vol. 70 10525

a-5 Miscellaneous

- A report entitled "A Case History of the Pointed Mountain Pipeline by the Northern Assessment Group" was tabled by ITC/COPE. Vol. 69 10454
- The terms of reference that Mr. Owen operated under relative to the Pointed Mountain Project were clarified by Foothills cross-examination. Vol. 70 10502-10507

B. Environmental

b-1 Inspection

- Mr. Owen's previous role in developing the original land use regulations was the subject of cross-examination by the N.W.T. Indian Brotherhood/Métis Association. It is up to DIAND to interpret the reports to see if West Coast complied with the regulations. The local Resources Management Officer (RMO) had no idea of the damage done by seismic crews after pipeline construction. He only knew of 3 of 9 incidents of seismic crossovers along the right-of-way. Vol. 69 10445-10447 Vol. 69 10447-10453
- DIAND had wanted to inspect the route one 'breakup' after construction but in order to assess the effects of erosion 3 breakups were allowed to pass before revisiting the site, according to Mr. Owen in cross-examination by ITC/COPE. During construction, the RMO inspected the job once a week, two fisheries people visited the site and the NEB inspector spent one day on the job. West Coast's own inspectors were experienced in pipeline work but not in permafrost. One government inspector per spread should be sufficient on a project. Inspectors cannot prevent things from happening. They just report. Vol. 69 10457 Vol. 69 10461-10467 Vol. 69 10483-10488
- Post construction seismic operations were the reason for much of the criticism of the project, according to Mr. Owen in cross-examination by Foothills. Mr. Owen declined to comment on the suggestions that the government's actions were open to criticism. Vol. 70 10525-10527

b-2 Right-of-Way

- The right-of-way terrain damage caused by the opening of borrow pits, seismic crossovers, erosion at stream crossing and at the Kootaneelee River and the LaBiche River was described by Mr. Owen. A series of slides was used to illustrate many of these problems. Vol. 69 10392-10403 Vol. 69 10405-10443
- Seismic work increases after the construction of a major transmission line, but there is nothing to stop these people from using the right-of-way, according to Mr. Owen in cross-examination by ITC/COPE. Limiting Vol. 69 10458-10461 Vol. 69 10489-10493 Vol. 69 10477-10480 10483

b-2 Right-of-Way (Cont'd.)

this type of use is up to DIAND. Many of the borrow pits opened after construction were for right-of-way remedial work and seismic purposes. Although the permit was for an 80 foot right-of-way, in places the right-of-way was 200 to 300 feet. The borrow sources should be more closely defined. Surface water erosion problems were also apparent. No channelling of river streams took place.

- It is difficult to assess what damage was done by seismic crews and what was done by the maintenance crews, according to Mr. Owen in cross-examination by Foothills. West Coast believed that it was the NEB's responsibility to keep the seismic crews off the right-of-way. The RMO didn't know who was responsible. The government seemed to be confused. Foothills' counsel suggested that it was standard procedure to refer seismic access requests to the NEB and DIAND. It was also suggested that DIAND had told West Coast not to take out the seismic crossovers. Mr. Owen conceded that it may be impossible to channel the streams along the West Coast right-of-way. He was not aware of the Schultz environmental survey of the Pointed Mountain line that was commissioned by West Coast. Foothills' counsel pointed out that on two occasions Mr. Owen had expressed to West Coast his general satisfaction with the work and had said he was going to recommend that the performance bond be reduced from \$500,000 to \$50,000. Mr. Owen could not recall this conversation.

Vol. 70
 10508-10512

 Vol. 70
 1517-1520
 Vol. 70
 10527-10532

b-3 Borrow Pits

- River gravel sources should not be permitted, according to Mr. Owen in cross-examination by ITC/COPE. The use of river gravel to bury part of the exposed Pointed Mountain pipeline was reported to DIAND. It wasn't known what sort of action was taken. Quite often permits lag behind the on-going projects they are to regulate. Compared to the requirements of the Ontario DOE, the procedures on this pipeline don't make sense.

Vol. 69
 10494-10499
- Alyeska experience in taking gravel from active flood plains was not known to Mr. Owen when asked in cross-examination by Arctic Gas. This will be brought up later in the environmental phase.

Vol. 69
 10500-10501
- Three pits were opened for maintenance reasons according to Mr. Owen in cross-examination by Foothills. A great deal of remedial work has been reported since June 1974 when he visited the site. Foothills' counsel suggested that when gravel was taken from the bed of the Kootaneelee River DIAND and DOE fisheries people were present.

Vol. 70
 10512-10517

 Vol. 70
 10524-10525

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 71 and 72)

COMMISSION COUNSEL WITNESS

D. Longlitz - Land Use Regulations

YELLOWKNIFE, N.W.T.

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TOPIC: Phase I: Engineering and Construction of the Proposed Pipeline

Land Use Regulations

DATE: September 26, October 14 and 15, 1975, in Yellowknife

WITNESS: Commission Counsel witness:

- D. Longlitz: Regional Head, Land Use Section, Water, Lands, Forests and Environment, Indian and Northern Affairs

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

- nil

B. Environmental

b-1 Administration

- The administrative procedures involved in examining a land use application leading to the issuance of a permit were described by Mr. Longlitz in cross-examination by ITC/COPE. The application is sent to the relevant communities through the field offices. A covering letter states the community response time and a phone call usually follows this up. In the office, consultation is initiated with other interested departments. The Advisory Board meets every two to three weeks to consider the information. The community input may or may not have been received at that time. If a major change is proposed by the Board the application may be deferred for another 30 days. Standard clauses dealing with such things as garbage control, etc., are often used. Other jurisdictions get a copy of the permit if it is relevant to them and, through consultation, they issue their permits or conditions simultaneously with the land use permit.

Vol. 71
10661-10673
- The permittee is often not asked to submit progress reports as required under Section 23 because the Department's (Indian and Northern Affairs) own inspectors report much faster according to cross-examination by ITC/COPE. A copy of the inspector's report is left on site and it outlines any remedial work that must be done as a warning or concern. The onus is on the inspector to ask for a suspension of work. Normally, the operators are co-operative and pay attention to the inspector's warnings. A final inspection is done on every project. The frequency of field visits is up to the individual inspector.

Vol. 71
10641-10642
- There have been about 10 or 12 prosecutions under the Territorial Lands Act over the last 4 years, according to Mr. Longlitz in cross-examination by ITC/COPE. This represents an ultimate failure since it is preferable, and often more costly to the operator, to suspend operations. The prosecutions are against the permittee, not individual employees.

Vol. 72
10698-10700

Vol. 71
10611-10614
Vol. 71
10614-10617

b-1 Administration (Cont'd)TRANSCRIPT
REFERENCE

- The permit application form is standard but requires the applicant to attach details of the proposed operation, according to Mr. Longlitz in cross-examination by ITC/COPE. The applicant sometimes confers with the Department in preparing its application. The refusal to grant a permit can be appealed to the Minister but Mr. Longlitz did not recall how often this had been done. There is no formal requirement to see community input but it is done as a matter of departmental policy.

Vol. 71
10630-10632
- The 'Non-Land-Use Permit' is used to guide those operations that technically don't fall within the scope of the Act, according to Mr. Longlitz in cross-examination by ITC/COPE.

Vol. 71
10632-10634
- Lands or surface rights disposed of by the Minister of INA are often regulated by agreements administered by the Land Management Section although enforcement may be done by the land use inspector, according to Mr. Longlitz in cross-examination by the NWT Indian Brotherhood/Métis Association.

Vol. 72
10712-10716
Vol. 72
10737-10738

b-2 Security Deposits

- The existing regulations which specify a maximum deposit of \$100,000 or \$1,000 per acre, are adequate to get co-operation from the applicants, according to Mr. Longlitz in cross-examination by ITC/COPE. Since he wasn't familiar with the proposed pipeline he had no comment on the adequacy of these ceilings for that project. If the terrain is damaged, the bond is withheld until restoration is completed to the Department's satisfaction. The Pointed Mountain project was not under this authority since it was a Land Management administered project. Not every permit has a security deposit. It depends on the project, the operator, terrain sensitivity, etc. The onus is on the operator to make good any damages in order to recover the bond.

Vol. 71
10620-10630

b-3 Regulation Revisions/Amendments

- Amendments to the Regulations are currently being considered to broaden coverage, according to Mr. Longlitz in cross-examination by ITC/COPE. This would include covering more operations, administrative changes, definition changes, etc. These are being done in Yellowknife, Whitehorse and Ottawa and were tabled at the Territorial Council's recent session.

Vol. 71
10634
Vol. 72
10692-10696

Vol. 72
10736

b-4 Staff

- A staff of 40 to 45 people are administering the Regulations and this will be expanded to account for broadening the application of the Regulations to the east, according to Mr. Longlitz in response to the Judge's questions.

Vol. 71
10651-10652
- The Public Service Commission is responsible for the recruitment of inspection staff, according to Mr. Longlitz in cross-examination by ITC/COPE. The qualifications and experience for the job were outlined. Recently a group of eight Native people have been trained on the job as inspectors. It wasn't known why this type of training has been discontinued.

Vol. 72
10700-10711

TRANSCRIPT
REFERENCE

b-4 Staff (Cont'd)

It takes an inspector about one season to be fully qualified. Backup is provided by a headquarters environmental staff officer.

- More staff would be required to handle the pipeline project, according to cross-examination of Mr. Longlitz by the EPB. Vol. 71
10659-10661

b-5 Start-up and Shut-Down of Projects

- The determination of start-up and shut-down dates was described by Mr. Longlitz along with the problems associated with summer operations. Vol. 70
10556-10563
Vol. 72
10736
- Historical shut-down dates by region were given by Mr. Longlitz, in cross-examination by ITC/COPE. The rough dates are given to the operator in advance, with the actual dates being determined by the inspector on a site specific basis. Vol. 71
10653-10659
- The same shut-down criteria are applied in the continuous and discontinuous permafrost zones, according to Mr. Longlitz in cross-examination by Arctic Gas. The season could possibly be extended by the application of artificial snow. There are some reservations about extending the period by limiting snow road use to colder parts of the day. Vol. 72
10729-10731
- An operator is notified one month in advance as to the tentative shut-down date, according to re-examination of Mr. Longlitz by Commission Counsel. Actual shut-down is then subject to a 48-hour notice on the basis of field conditions. Vol. 72
10738-10741

b-6 Access Snow Roads

- The construction of access roads, river crossings and techniques of clearing were described by Mr. Longlitz with a series of slides. Vol. 70
10540-10556
- The problems of high stumps could be overcome by summer clearing with crew access by helicopters, according to Arctic Gas' cross-examination of Mr. Longlitz. Vol. 72
10717-10718
- The EPB Code on snow roads may be asking the pipeline companies to submit information that is impossible to determine, according to Mr. Longlitz. For example, the number of passes on the proposed road may be a difficult determination and may not be relevant once the road is in place. Also the emphasis should be on the vehicle ground bearing pressure rather than gross vehicle weight. Harvesting of snow confined to a precleared right-of-way or lake may be a valid condition but could make things difficult for the operator. Vol. 71
10601-10608
- Although orthophotomosaic contour mapping and ground surveys to identify the location of access roads would be useful, the important thing is to communicate information to the people in the field, according to Mr. Longlitz in cross-examination by Arctic Gas. Vol. 71
10608-10609
- Although orthophotomosaic contour mapping and ground surveys to identify the location of access roads would be useful, the important thing is to communicate information to the people in the field, according to Mr. Longlitz in cross-examination by Arctic Gas. Vol. 72
10716-10717

b-6 Access Snow Roads (Cont'd)TRANSCRIPT
REFERENCE

- Eight inches of frost is generally adequate to support cat type vehicles involved in access road construction, according to Mr. Longlitz in cross-examination by Arctic Gas. The degree day criteria has not been found to be workable. Mr. Longlitz was not familiar with the Inuvik snow road test. Some snow cover would be desirable to protect the surface vegetation before allowing LGP vehicles onto the right-of-way to induce frost penetration. If there was sufficient frost penetration and six to eight inches of snow on the right-of-way, pipeline construction could probably start. Vol. 72
10718-10729
- Limbed logs in ice bridges would be acceptable if they were removed prior to breakup, according to Mr. Longlitz in cross-examination by the EPB. Vol. 71
10609-10611

b-7 Miscellaneous

- The Federal-Territorial Planning Authority for the Mackenzie Delta has no bearing on the Land Use Regulations or their administration, according to Mr. Longlitz in cross-examination by ITC/COPE. Vol. 72
10691

C. Socio-Economicc-1 Community Involvement

- Things such as traplines are often considered when drafting a permit but generally social concerns are not, according to Mr. Longlitz in cross-examination by ITC/COPE. It is becoming more common to send a copy of the permit to the community where real concern is expressed. Comments are sought from Hamlet and Town Councils so that local people know the details of any proposed activity. A joint advisory group as requested by the Delta communities wasn't formed. The request was handled locally. There would be no problem in having community representatives attend the Land Use Advisory Board meetings although they would have better involvement at their local council. The meetings are not public. Vol. 71
10686-10688
Vol. 72
10696-10698
Vol. 71
10674-10686
- The problem of delay in communities receiving requests for comments is known to the Department, according to Mr. Longlitz in cross-examination by ITC/COPE. The Judge pointed out that this is a complaint that has been heard by the Inquiry in virtually every community. Either the permit application isn't received in time to make comments or the permit has been issued and comments are sought afterwards. Vol. 71
10642-10646

D. Miscellaneousd-1 General

- The statement prepared by the Department of Justice for Civil Servants appearing before the Inquiry was read into the record by Commission Counsel on behalf of Mr. Longlitz and filed as exhibit #272 for reference by subsequent government witnesses. Vol. 70
10535-10538

TRANSCRIPT
REFERENCEd-1 General (Cont'd)

- The following exhibits were filed as previously requested:

- | | |
|---|------------------------|
| (a) The list of publications, papers and thesis referred to by Dr. P. Williams in his testimony on Frost Heave. | Vol. 71
10598-10600 |
| (b) Foothills report on Scour. | Vol. 71
10600-10601 |
| (c) The Pointed Mountain agreement between the Crown and Westcoast Transmission. | Vol. 72
10689 |

d-2 Frost Heave

- | | |
|---|---------------------------------------|
| - The Judge addressed three questions to Arctic Gas on the apparent conflicts in evidence on frost heave between Arctic Gas and Dr. Peter Williams and asked that these be answered in CAGPL's rebuttal evidence. | Vol. 72
10731-10735
10741-10746 |
|---|---------------------------------------|

Policy and Planning
ACND Division
October 28, 1975.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(Transcripts Nos. 70 and 72)

Commission Counsel Witness

Dr. C.P. Lewis - River EnvironmentsYELLOWKNIFE, N.W.T.SEPTEMBER 26 AND OCTOBER 15, 1975

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TOPIC: Phase I: Engineering and Construction of the
Proposed Pipeline

RIVER ENVIRONMENTS

DATE: September 26 and October 15, 1975 in Yellowknife

WITNESS: Commission Counsel's witness

Dr. C.P. Lewis: Physical Scientist, Terrain
Sciences Division, Geological
Survey of Canada.

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Engineering/Technical

a-1 General

- The definitions of valley wall, river terraces, valley plains and active channels were reviewed by Dr. Lewis pointing out that Arctic Gas had not been consistent in using some of these terms in the past (see a-4 below). A description of river longitudinal profiles, channel patterns and permafrost beneath North Slope rivers was given. The hydrologic characteristics of these rivers were explained. Although there is very little known about the total annual discharge and its distribution throughout the year, CAGPL's methods on the Firth and Babbage Rivers appear to be conservative and therefore acceptable. In cross-examination by Arctic Gas, Dr. Lewis explained that his work at the Babbage and Deep Creek areas included the collection of precipitation data at Kay Point.

Vol. 70
10567-10571

Vol. 70
10571-10576

Vol. 70
10576-10579

Vol. 72
10772-10773

a-2 Subsurface Flow and Icings

- Groundwater flow is known to exist beneath North Slope rivers and this is critical for the pipeline crossings of the Malcolm and Firth Rivers, according to Dr. Lewis. The chilled pipeline's frost bulb could cut off the flow causing icings and affecting channel stability.

Vol. 70
10587-10589
- The input data for the Batelle model "A convective model for subsurface flow around a chilled pipe" was cause for amazement, according to Dr. Lewis. Two of the three examples used in the PAAG responses were not applicable to the North Slope rivers. The third example shows that in rivers like the Malcolm and the Firth, flow would be stopped or disrupted. The culvert solution, as proposed by Arctic Gas, is not incorporated in the Batelle model. After construction is not the time to test the concept.

Vol. 70
10589-10593
- The theory of heat flow is not sufficiently familiar to Dr. Lewis to enable him to know if the ground water flows would be sufficient to keep the proposed culverts open, according to cross-examination by the EPB. The flow could be continuous or intermittent, depending on the site. Additional field investigation and field testing is needed.

Vol. 72
10747-10753

a-2 Subsurface Flow and Icings (Cont'd.)TRANSCRIPT
REFERENCE

- The Batelle model is just a representation of reality and should be field tested to prove its validity, according to cross-examination of Dr. Lewis by the EPB. Vol. 72
10755-10757
- Culverts have not been suggested for surface cross slope drainage, according to counsel for Arctic Gas during the EPB cross-examination of Dr. Lewis. Vol. 72
10753-10755

a-3 Scour, Sedimentation and Erosion

- Little is known about the sediment transport characteristics of northern rivers, according to Dr. Lewis. It varies seasonally. In the spring the first flow is over the ice which protects the river bed from scour thereby inhibiting bed load transport. The scour depths predicted by CAGPL are probably conservative. Vol. 70
10579-10583
- Further information on bank erosion should be obtained before river training works, as proposed, are permitted on active channel beds, according to Dr. Lewis in chief and in cross-examination by Arctic Gas. If this information is not made available, the deep burial mode (for the pipeline) should be required across the entire width of the active channel. Arctic Gas pointed out two reports which already provide data on scour for north slope rivers in Alaska. Vol. 70
10583-10584
Vol. 72
10773-10774
Vol. 72
10776

a-4 Gravel from Rivers

- Arctic Gas seems to be proposing gravel mining operations from terraces, active flood plains and large portions of the active channel bed, according to Dr. Lewis. This could affect the pipeline integrity and the fish in the river. In cross-examination by Arctic Gas, Dr. Lewis pointed out that, although terminology seems to be the problem, Arctic Gas' definitions changed and, in fact, they should say that they plan to mine from active river channels. Vol. 70
10584-10587
Vol. 72
10768-10770

a-5 Tuk Harbour

- The entrance to the Tuk harbour is shallow and would require almost continual dredging to keep open for deep water vessels, according to Dr. Lewis in cross-examination by ITC/COPE. The only suitable deep water port would be at Babbage Bight on the Yukon coast. The Tuk coast is rapidly retreating and could get worse. The Judge expressed interest in this because of Foothills proposal to bring fuel into their construction camps from the north utilizing a 35,000 ton tanker through the Bering Strait to Tuk. Vol. 72
10759-10765
Vol. 72
10765-10766
- The Husky Lakes dredging proposal by the Producers was not familiar to Dr. Lewis. Vol. 72
10766-10767

a-6 Miscellaneous

- The information resulting from seismic and geophysical work used to evaluate the fill and permafrost characteristics of the Blow and Malcolm Rivers will be published within the next few months, according to Dr. Lewis in cross-examination by Arctic Gas. Vol. 72
10771-10772

TRANSCRIPT
REFERENCE

a-6 Miscellaneous (Cont'd.)

- The documents that Dr. Lewis relied on in his testimony were listed and filed as exhibits.

Vol. 72
10758-10759

B. Environmental

nil

C. Socio-Economic

nil

D. Miscellaneous

- The start-up and shut-down dates for winter projects in the Mackenzie area, as supplied by Mr. Lonqlitz were filed as exhibits. Vol. 72 10758

E. Inquiry Schedule

- During the week of October 20 to 24 the tentative schedule indicates that Phase I will be completed with the calling of previous witnesses who have not yet been cross-examined. In the latter part of the week Arctic Gas' combined Phase II and III evidence (Physical and Living Environment) is expected to be heard. The objective is to complete Phases II and III by Christmas, sitting as follows:

October

20-24: in Yellowknife; last part of Phase I and the introduction of evidence in chief for Phases II and III.

November

3-21: in Yellowknife; Phases II and III with recall of Phase I rebuttal witnesses for cross-examination as required.

December

1-19: in Yellowknife; Phases II and III.

January-February

: tentative plans indicate that the Inquiry will go to Inuvik for formal hearings on the cross Delta routing alternative and on the Delta Gas Producers Plans. Community hearings will probably be called in Inuvik, Tuk, Sachs Harbour, Holman Island, Polatuk, Aklavik and Arctic Red River.

It appears that the Inquiry is aiming for a June completion date.

Policy and Planning
(ACND) Division
October 28, 1975

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 51 TO 55)

CANADIAN ARCTIC GAS
 ALTERNATIVE PIPELINE CORRIDORS AND ROUTES
 WHITEHORSE, Y.T.
 AUGUST 11 TO 15, 1975

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TRANSCRIPT VOLUMES NOS. 51 to 55

TOPIC: Phase I: Construction and Engineering
Alternative Pipeline Corridors and Routes.

DATE: August 11 to 15, 1975, Whitehorse, Yukon Territory.

WITNESSES: Panel on Alternative Pipeline Routes.

P.H. Dau	- President Northern Engineering Services Company Ltd. NES
J.R. O'Rourke	- Co-ordinator Pipeline Logistics Planning C.N.R. Manager of Industrial Development
G.L. Williams	- Director of Field Services, NES
J.I. Clark	- Supervisor of Geotechnical and Environmental Studies NES
R.A. Hemstock	- Director of Environment Studies
A.W. Banfield	- Environmental Consultant
W. Trusty	- Economic Consultant

The Following Witnesses Appeared During the Course of the Hearings:

WITNESSES FOR COUNCIL FOR YUKON INDIANS:

J. Jacquot	- Council for Yukon Indians
D. Joe	- Council for Yukon Indians
A. Lueck	- Council for Yukon Indians
S. Sorecker	- Magistrate, Glenallen, Alaska

WITNESS FOR INDIAN BROTHERHOOD:

J. Wah-Shee	- Indian Brotherhood, Northwest Territories
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WITNESSES FOR CANADIAN ARCTIC GAS RESOURCES COMMITTEE:

A. Thompson	- President Arctic International Range Society
R. Leonard	- Arctic International Range Society
G.L. Collins	- Arctic International Range Society
Valerius Geist	- Environmental Research Centre, University of Calgary
R. Weedon	- Policy and Planning, State of Alaska
W. Parker	- Commissioner of Highways, State of Alaska

INTRODUCTION:

Arctic Gas has considered the Prime Route and four alternative routings. The routings briefly are:

- (a) The Prime Route (2,629 miles, \$5.7M) moving easterly 5-15 miles inland from the Beaufort Sea, extending east from Prudhoe Bay to Shingle Point thence south and east to the Travaillant Lake junction and then south through the Mackenzie Valley.
- (b) The Offshore Corridor (2,638 miles, \$6.3M) which extends east from Prudhoe Bay moving offshore to avoid the American Arctic National Wildlife Range, returning to land in the Yukon and proceeding east to approximate the prime routing direction.
- (c) The Interior Corridor (2,674 miles, \$6.3M), extending southeast from Prudhoe Bay into the Yukon and then extending east to the MacMillan Pass and on to the Travaillant Lake junction and south through the Mackenzie Valley.

- (d) The Fairbanks Corridor (3,549 miles, \$8.13M) following the Alyeska pipeline to Big Delta and thence southeast along the Alaska Highway. A Mackenzie Delta lateral following the Dempster would be involved to pull in Delta gas.
- (e) The Fort Yukon Route (3,044 miles, \$6.7M) follows the Alyeska route to Galbraith Lake, Alaska then southeast to Dawson, Pelly Crossing and the Alaska Highway. This route would also involve a Delta lateral along the Dempster Highway.

Geotechnical considerations, as contained in the direct evidence, indicated the Interior Route has 745 miles of continuous permafrost compared to 700 on the Prime Route and 400 on the Fairbanks Corridor, 710 on the Offshore Corridor and 430 on the Fort Yukon Corridor. The Fairbanks Corridor has 1,800 miles of discontinuous permafrost followed by the Fort Yukon Corridor with 1,300 and the remaining alternatives, 775 each. The Fairbanks Corridor has 850 miles of mountainous terrain, the Fort Yukon Corridor 725, the Interior Route 170 and the Prime and Offshore Corridors 0.

Arctic Gas Conclusions On Alternative Routes

TRANSCRIPT REFERENCE

- The Offshore Corridor is eliminated because it is undesirable in terms of service continuity and cost. A Fairbanks pipeline would result in the longest total pipeline system and would produce highest capital and unit transportation costs. It would put gas near Fairbanks, Alaska, Whitehorse and additional small communities. Its greater length has environmental significance. Mackenzie Delta supply lateral proceeds through partially disturbed areas (Dempster Highway). The Fairbanks Corridor does not traverse areas with as high a gas potential as does the Prime Route. There is a substantial possibility there would be a later need to construct some or all of the northern portion of the Prime Route to connect additional gas supplies. Fort Yukon Corridor would bring gas near Fort Yukon but not the City of Whitehorse and other Alaskan Highway villages west of Whitehorse.

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Both Fairbanks and Yukon Corridor would generate more employment in the north but this would be reflected in a greater cost to consumers and/or lower well-head gas prices.

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Arctic Gas concluded routing utilizing the Mackenzie Valley offers the greatest net advantage to both Canada and the United States.

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Arctic Gas concluded the choice is between Prime and Interior Route. The Interior Route is longer and traverses two mountain ranges. It is substantially more expensive to construct and operate than Prime Route. It does not cross the North Slope or offshore areas which are rated as having the highest potential for future additional gas supply.

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Note: Costs are 1973 costs as projected. See Page 9 of Appendix A for mileages and Page 19 for 1973 capital cost differences. Spread requirements for the routes vary from 11 for the Interior Route to 9 for each of the four remaining alternative routes (Page 14).

Arctic Gas conclusion was that none of its potential routes would have a substantial adverse effect on wildlife, aquatic resources, soil or vegetation of the regions and the Prime Route would have least effect due to its shortness and partial location on the generally less productive Arctic Coast.

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HIGHLIGHTSA. Technical Highlightsa-1 "Pipeline Corridors" Not Used As In Pipeline Guidelines

- Mr. Hemstock of Arctic Gas said in comparing corridors Arctic Gas had not used terminology as used in Pipeline Guidelines relating to a "transportation corridor". He stated the idea of a transportation corridor having a pipeline and other modes of transportation is quite different from a corridor having only a pipeline. The term pipeline corridor is used in the sense of directly comparing one segment of pipeline routing with another. Vol. 51
6873

a-2 Pipeline Length

- Considerable discussion revolved about the distance of the Fairbanks Corridor as against the Prime Route. Without the Mackenzie Delta Lateral (737 miles) the route would be 326 miles longer than the Prime Route, or 3,549 miles in length. Vol. 51
6837-6841

a-3 Edge of Shield Corridor

- Foothills asked whether Mr. Hemstock was familiar with the Edge of the Shield Corridor and East of Franklin Route. Mr. Hemstock said Arctic Gas had only looked at the routes in a general way. Vol. 52
6827
- Mr. Williams saw an all weather road as being necessary. Vol. 52
6828
- Mr. Hemstock said Arctic Gas regards the Mackenzie River as being a major transportation artery in pipeline development.

a-4 Shallow Bay Alternative

- CARC queried Mr. Dau on the status of Shallow Bay Routing alternative. Mr. Dau said he understood Arctic Gas was awaiting the conclusion of some studies conducted in the summer of 1975. Vol. 52
6939
- Dr. Banfield said he would be concerned with waterfowl nesting areas. Vol. 52
6954
- Mr. Dau said ice movement was more restricted in Shallow Bay than Beaufort Sea and that dual pipeline crossings were planned as a maintenance safety factor. Vol. 52
6956

a-5 Beaufort - Delta Oil Project Ltd.

- CARC produced a copy of a government memorandum of July 15, 1975 dealing with a Beaufort Delta Oil Project and indicating a government committee would be set up to study, investigate and report on the proposal. Arctic Gas representatives said they were aware of the project. Vol. 52
6902-6903
- The Commissioner suggested one would have to look at whole development scenario, gas and oil pipelines. He suggested there would be a construction project in the Valley which might last ten, fifteen or even twenty years in the development of a Mackenzie Valley Transportation corridor. Vol. 52
6910

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a-6 Choice of Routes

- Mr. Carson Templeton questioned Arctic Gas on when Prime and Interior Routes were chosen. Mr. Dau said in 1969-70. The alternative routes were considered in 1973. Vol. 52
7072
- Mr. Hemstock of Arctic Gas, in cross-examination, said two general routes (Prime and Interior) were chosen before environmental or social studies were done. Vol. 52
7025
- Mr. Dau said economics or economic factors including safety of pipeline were prime considerations in routing choice and planning a new pipeline system. Vol. 52
7028

a-7 State of Alaska Position on Pipeline Routes

- State of Alaska has advocated a Trans-Alaska gas pipeline route which makes use as much as possible of the existing Trans-Alaska oil pipeline corridor. The State was concerned about 200 miles or so of land which the Arctic Gas Prime Route would cross and which is an intrinsic component of the Arctic National Wildlife range. The State considers an intrusion is counter to established Congressional policy as expressed in the Alaskan Native Claims Settlement Act of preserving large parts of the Alaskan wilderness from exploitation. The State of Alaska does not support or endorse the El Paso proposal but it supports a Trans-Alaska pipeline along the pipeline corridor routing now being used by Alyeska. Vol. 54
7544-7545

a-8 Petroliferous Areas

- Arctic Gas said in Alaska, the Arctic Slope province, an area of 100,000 square miles, has 70,000 square miles which are considered potentially petroliferous. This Arctic Slope province includes the Brooks range southeast of Prudhoe Bay and 20,000 square miles of sedimentary rock under the Beaufort Sea. Both the Prime Route and Offshore corridors are located within the Arctic Slope province and gas has been found in various locations. Mr. Hemstock of Arctic Gas said the Mackenzie Delta-Beaufort Basin is ranked the number one petroliferous area in the Territories. Vol. 51
6782
- The Interior Route, Prime Route and Offshore Corridor have common easterly routings through or by, not only the Mackenzie Delta - Beaufort Basin, but also the third level province of potential gas supply, the Peel Plateau south to Fort Simpson.
- Mr. Hemstock, Arctic Gas, indicated the Fairbanks and Fort Yukon Corridors, after traversing Prudhoe Bay and Mackenzie Delta areas, move through areas of less likely gas and oil productivity.
- Arctic Gas said gas exploration and development is substantially affected by the availability of a pipeline.

a-8 Petroliferous Areas (Cont'd.)

- Commission Counsel questioned Mr. Hemstock on potential gas reserves. Mr. Hemstock outlined the following:

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7146-7151

Mackenzie Delta-Beaufort Basin	6.4 Tcf
Banks Island	11.4 Tcf
Peel Plateau	7.2 Tcf
Eagle Plain	5.7 Tcf
Old Crow	0.72 Tcf
Anderson Plain	1.4 Tcf
Tathlina Craton	11.7 Tcf

a-9 Pipeline Costs

- Mr. Dau, Arctic Gas pointed out that costing of the Prime Route had been done in a vast amount of detail but not the same amount of detail had been done on the Fairbanks and Fort Yukon alternatives. Under cross-examination from Foothills, Arctic Gas said Canadian portion of the Fairbanks Corridor would be 5.89B dollars; the Canadian portion of Fort Yukon 5.2B dollars, and Prime Route 5.7B dollars. Mr. Dau said cost of Mackenzie Delta lateral to hook up with Fairbanks Corridor would be 1.87M. The Base escalated cost of the Canadian sector Prime Route in 1974 dollars was 7.1B. Under cross-examination by Foothills, Arctic Gas admitted it had no contingency system if there was a delay in pipeline start-up and could not give any indication of how much cost would be increased. Vol. 51
6979
- Under cross-examination from Foothills, Mr. Dau said the magnitude of financing requirement was creating doubts about ability to finance Fort Yukon or Fairbanks Route. This represented both Alaskan Arctic Gas and Canadian Arctic Gas position on these alternatives. Vol. 51
6868
- Mr. Gibbs of Foothills questioned Mr. Dau as to why there was a projected 5.2M difference in annual operating costs in 1982 between Fairbanks and Prime Route. Mr. Dau said difference in costs reflected additional manpower, equipment, district headquarters, repair and replacement of parts due mainly to greater mileage. Vol. 51
6863

a-10 Financing

- Mr. W. Trusty, in response to Mr. Gibbs' suggestion that capital costs south of the 49th parallel should be included to give total system costs, said other companies would be handling capital costs south of the 49th parallel. Their plans meshed with Arctic Gas and there was confidence capital markets would support both. Vol. 52
6870
- Foothills queried why Arctic Gas could not finance 5.89B dollars of Canadian portion of Fairbanks Corridor if it could finance 5B dollars cost of Canadian portion of Prime Route. Mr. Trusty said both Alaska Arctic Gas and Arctic Gas were relying on the same capital markets. Vol. 51
6869
- Foothills argued that Fairbanks Route should be compared to other routes using segment costing in order that Canadian consumers could decide on route. Vol. 51
7057
- Mr. Marshall said segment by segment route costing not available through Northern Engineering Services or computer program "Nectar" used by Arctic Gas.

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a-10 Financing (Cont'd.)

- The Commissioner ruled that Arctic Gas must show segmented costs for alternative routes.

a-11 Logistics Costs

- Mr. O'Rourke was unable to supply logistics costs for the alternative routes as requested by CYI. Vol. 52
- Arctic Gas said alternatives to Prime Route would require earlier and more time-consuming logistics support. The Offshore Corridor was rejected because of service continuity and cost. Fairbanks Corridor would produce highest capital and unit transportation costs. Vol. 52
6815
- Mountainous terrain precludes construction of airstrips at some of compressor station sites in the Fairbanks and Fort Yukon Corridors. This was not a problem along Prime Route.
- Mr. Dau said Arctic Gas believed it would have access to Prime Route at all times. Mr. Dau also said in his opinion there would never be a road to the North Slope as far as Arctic Gas. Vol. 52
6886
Vol. 52
6887
- Mr. Dau said barge costs much cheaper than trucking. He said under questioning by Mr. Veale, that Fairbanks/Whitehorse logistics costs would be much higher than logistics costs using barges on Mackenzie River. Vol. 52
6980

a-12 Use of Dempster Highway

- Mr. O'Rourke, under question from Mr. Veale, said 138 miles of pipeline would be trucked up Dempster Highway for Interior Route if Interior Route was chosen. Vol. 52
6977

a-13 Skagway Wharf

- Mr. O'Rourke said if pipe for Interior Route arrived in Skagway port in summer there would be some conflict in making use of existing wharfing facilities; an extra berth might be required. Vol. 53
7164

a-14 White Pass and Yukon Railway

- Mr. O'Rourke, in reply to Commission Counsel, said Arctic Gas would use existing facilities of White Pass and Yukon Railway. He did not see requirement for additions to rolling stock. Vol. 53
7164

a-15 Transshipment Point - Whitehorse

- Mr. O'Rourke said there would be a transshipment point at Whitehorse requiring 25 people. A pipe trucking operation up the Dempster Highway would require 75 people. Vol. 53
7165

a-16 Legal Load Limits

- Mr. O'Rourke said pipeline loads on Dempster Highway would be kept to legal load limits.

a-17 Contractors' Equipment and Camps

- In response to questions from CYI, Mr. O'Rourke said contractors' equipment and camps for Interior Route would be brought into Yukon from Arctic Red River jump-off point. Vol. 52
6973

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a-18 Number of Airstrips

- Mr. Dau agreed with Mr. Veale that fewer air-strips would be necessary on the Fairbanks Corridor than on Interior or Prime Routes. Vol. 52
7014

a-19 Very Few Airstrips - Delta Link

- Mr. Williams, Arctic Gas, said Mr. Dau might have overlooked need for additional airstrips from Delta to Whitehorse hookup with Fairbanks Route via Dempster Highway. Vol. 52
7015

a-20 Water Requirements

- Mr. Veale questioned Mr. Williams on water requirements. Mr. Williams, in reply, said difference in Interior Route requirements for water (3M bbls) and Prime Route requirements (14M bbls) related to need for snow roads and ditch flooding on Prime Route. He added that Arctic Gas' increased knowledge of snow fences and snow accumulation for snow roads would substantially reduce the amount required on the Prime Route. Vol. 52
7007

a-21 Minimal Use of Gravel

- Mr. Parker said minimal use of gravel was achieved in Alaska through construction of winter work pad, allowing mobilization of heavy equipment when ground is well frozen. Heavy equipment is taken off the work pad well prior to thawing conditions. The work pad associated with the oil pipeline is handling only traffic associated with construction - greater bulk of traffic carrying supplies and equipment is proceeding over haul road or state highways. Vol. 54

a-22 Gravel Pad or Road

- Mr. Hemstock, replying to questions from COPE, said that Arctic Gas sees more impact on the environment as a result of the construction of a gravel pad or road. Vol. 53
7083
- COPE said it understood that a permanent road would be required along part of the Interior Route. Mr. Williams said a permanent road would be required in mountain areas. Vol. 53
7083
- Mr. Williams said if a gravel work pad was deemed necessary there would be a strong recommendation from environmentalists not to maintain it beyond the construction period. Vol. 53
7090
- Mr. Hemstock said there would be concern about a permanent road on the Interior Route due to narrow valleys which are the migration routes for wildlife. Vol. 53
7084
- COPE asked about facilities to connect pipeline with North Slope hydrocarbons. Mr. Hemstock said roads could be minimized in development of field facilities in that automation will handle well-head operations. Vol. 53
7091
- Dr. Banfield said, environmentally, the effect of hydrocarbon development close to Prime Route would be synergistic. Vol. 53
7096
- The CVI pointed out that an existing all-weather road would provide access on the Fairbanks Route Vol. 52
7013-7014

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a-22 Gravel Pad or Road (Cont'd.)

and would thereby reduce the time frame of construction. Mr. Dau said there were problems with summer construction and rain, and the pipeline route in many cases would be several miles from the highway.

a-23 Snow Roads

- Dr. Banfield said the concept of snow road use in construction was considered to be one of the prime mitigating factors in terms of the environmental impact of the project. Dr. Banfield said he would not like a road on either Prime or Interior Route. Environmentalists accepted Prime Route because no permanent roads were required. Vol. 53
7086
- Dr. Leonard, witness for CARC, was of the opinion that snow road use on Prime Route would be far less harmful to wildlife and wild rivers than future permanent highways that would result along other routes. Vol. 53A
- Mr. Collins said he would recommend Prime Route provided it was constructed in winter only with heavy maintenance work and heavy logistic support being carried out in that season. He felt there should be no public use of airstrips, helipads or wharves.
- Mr. Parker, Alaskan witness, said a pipeline requires adequate surface access, good all-weather road; gravel pads are inadequate. Mr. Parker said minimally constructed roads degenerate during periods of rainfall and do not stand up under heavy truck traffic. The State highway constructed in conjunction with Alyeska project was built to secondary highway standards and is satisfactory. He said the snow road concept had not been satisfactorily proven to the State of Alaska. Vol. 54
7534
Vol. 54
7535

B. Environmental

b-1 General Impact on Wildlife

- Mr. Hemstock of Arctic Gas said Arctic Gas had studied fur bearers along Prime and alternative routes during the past 3-4 years and believed a pipeline would have little effect on wildlife or on the trapping economy of the land. Vol. 53
7066
- Mr. Hemstock said there would be a local effect on wildlife in that, as construction went through, wildlife would move back some distance from construction area. Vol. 53
7067
- According to Mr. Hemstock, areas used for compressor stations would be taken out of wildlife productivity. Wildlife would abandon such areas. Vol. 53
7067
- COPE made reference to recreational hunting and trapping by construction and maintenance personnel being prohibited by Arctic Gas. COPE asked Dr. Banfield about sports fishing. He indicated it was felt that sports fishing would provide a means of getting better data on resources.
- Mr. Trusty said, as construction would be in winter, people would not be prone to wander off to hunt and trap as had occurred in Alaska. Vol. 53
7117

b-2 Incremental, Cumulative, Synergistic Effects

- Mr. Hemstock said in case of a pipeline along a highway there would be an incremental effect from a pipeline. In an untouched area, after implementing one transportation mode, additive transportation modes would be incremental. Vol. 51
6875
- Dr. Banfield explained synergistic or multiplicative impact. A number of factors interact in two ways. One is antagonistically - in which one cancels the action of another; and the other, synergistically - in which one factor enhances the total application of the interaction. When such a action takes place this is alternative to antagonistic and is called synergistic. Vol. 51
6877
- Dr. Banfield indicated cumulative impact of two pipelines may exceed the tolerance level and adaptability of fish, raptors, large mammals and certain plant communities. Vol. 51
6878
- Dr. Banfield said he recommended to Arctic Gas that it stay as far away from Mackenzie Highway as possible. Vol. 52
6893
- Under cross-examination, Dr. Banfield said he expected a multiplicative or synergistic effect to apply if there was an oil pipeline as well as a gas pipeline along the North Slope.
- Regarding two pipelines in the Mackenzie Valley Dr. Clark said he and his colleagues could see nothing from a terrain point of view which would present insurmountable difficulties. Dr. Banfield said that in looping of the line, use of the same right-of-way, compressor stations etc., would be mitigating factors in terms of a dramatic incremental increase in environmental effects.
- Dr. Banfield stated he had not conducted any studies on cumulative or synergistic or inter-related effects of mainline construction and subsequent looping. Vol. 52
6897
- Dr. Banfield said Arctic Gas had conducted some studies of the cumulative effects of a highway and a pipeline in the Donnelly River - Chick Lake area because river crossings of the Mackenzie Highway and proposed pipeline are close together. Mr. Hemstock said studies are continuing and 1974 progress reports are available. Vol. 52
6893-6894
- CARC questioned whether any synergistic studies had been done on Mackenzie Delta Gas facilities and pipeline. Dr. Banfield said the Delta facilities had not been considered cumulative in terms of a corridor concept. The Delta facilities had been considered as secondary effects. Vol. 52
6897

b-3 Porcupine Caribou Herd

- Dr. Banfield said Fairbanks Corridor would be less serious to Porcupine caribou herd than Prime Route. Vol. 52
6999

b-3 Porcupine Caribou Herd (Cont'd.)

- Dr. Banfield said if procedures such as winter construction, use of snow roads, confinement of activity through station and compressor station pads and other mitigative procedures followed, he felt Porcupine herd would not be substantially affected or impacted by Prime Routing.
- CYI questioned Dr. Banfield on Mr. George Calef's opinion pipeline should follow Interior Route to avoid caribou fawning grounds where Mr. Calef felt there would be interaction between the pipeline and caribou for 2½ to 3 months each year. Dr. Banfield said he did not agree with this opinion since information after 1973 shows caribou spend considerable amount of time in the winter in the vicinity of the Interior Route.
- Mr. Hemstock said a monitoring operation was being carried out on Porcupine caribou herd.
- Dr. Banfield said Fort Yukon and Fairbanks Routes traverse the ranges of several other caribou herds. The Fairbanks route is on the edge of the winter range of the Porcupine caribou herd.
- In cross-examination by CARC, Dr. Banfield said fawning range of the Porcupine herd is restricted, therefore a routing across extensive winter range is less hazardous. Vol. 52
6996
- Dr. Valerius Geist, witness for CARC, said the northern coastal zone of the Yukon and the Old Crow Flats are very important in the caribou yearly cycle. Caribou use these areas to calve, for nursery areas and to fatten up. Dr. Geist said herd is a treasure; it is the only animal which converts useless plants on the North Slope into protein. Vol. 53A
7366
- Dr. Geist pointed out caribou could be enormously susceptible to harassment when they are in a positive energy budget on their summer range. Dr. Geist wondered whether Arctic Gas could reconstruct the caribou herd if it was irreparably disturbed by pipeline. Dr. Geist said summer range subsidizes existence of caribou during winter when they are in the mountains in a subsistence environment. Dr. Geist said he felt Prime Route would result in a loss of caribou range - saying he would prefer Fairbanks Route followed by Interior Route as far as herd was concerned. Vol. 53A
7410
Vol. 53A
7368
Vol. 53A
7434
- Dr. Weedon said caribou are essentially wilderness animals depending on climax vegetation and requiring very large, undisturbed areas for seasonal movements. If the Porcupine caribou herd abandoned its calving areas north of the proposed Prime Route, it might not be successful in calving elsewhere and maintaining its numbers. Vol. 54
7476-7477
- Dr. Banfield said Arctic Gas did not have an ideal amount of knowledge but that Prime Route is tolerable or acceptable in terms of impact on caribou. Vol. 52
6933
- The Commissioner asked Dr. Banfield about means of quantifying risk to the herd. Dr. Banfield replied environmentalists have no way of coming up with a cost-benefit type of assessment of risk. Dr. Banfield said environmentalists had conducted an overview Vol. 52
7002

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b-3 Porcupine Caribou Herd (Con'd.)

analysis and felt they had come to a preliminary conclusion about environmental impact and risks of other corridors.

b-4 Other Caribou Herds

- Dr. Banfield said the Western Arctic Herd would be affected by development of Naval Petroleum Reserve No. 4. Prudhoe Bay is on the eastern margin of the herd.
- Dr. Banfield said that the Edge of the Shield Corridor would cause severe concern among wildlife biologists in that it would move right into the heartland of the Bluenose herd estimated at 100,000. Vol. 54
7442
7443
- Dr. Banfield made reference to the Kaminuriak herd in the Keewatin which might be affected by a Polar Gas Pipeline. Vol. 54
7447
- Dr. Geist, in cross-examination by Mr. Veale, said Mackenzie Delta lateral along Dempster Highway would be the lesser of two evils compared to Prime Route as far as the Porcupine herd was concerned. Vol. 54
7432

b-5 Large Scale Migration

- Dr. Geist, using the decline of the Forty Mile Herd in the southern Yukon in the 1920's, 1930's and 1940's as an example, said it would be impossible to reconstitute a migration on the scale of the Forty Mile Herd's movement. Vol. 53A
7383

b-6 Mountain Sheep

- Dr. Geist said mountain sheep can withstand large-scale disturbances. If there were no roads he felt there would be less serious impact. He expressed concern about secondary roads over which applicant would have no control, using Mackenzie Delta lateral along Dempster Highway as an example. Vol. 53A
7391
- Mountain sheep are incredibly resilient if there is no hunting. As to overflights, Dr. Geist said regular flights of 1,000 would create no disturbance but occasional flights would stimulate anxiety.
- Speaking of the Fort Yukon Route, Dr. Geist said he did not like to think of that route as it passed through the last Stone Sheep area in the Yukon. He also feared the consequences of outgrowth activities on Dawson and St. Cyr Dall sheep populations. As for the Fairbanks Corridor, mountain sheep had already been severely disturbed. Vol. 54
7419

b-7 IBP Sites

- CARC questioned Mr. Hemstock about proposed IBP site in the Ebbutt Hills and pipeline impact. Vol. 52
6953
- Later, Dr. Valerius Geist, CARC witness, said IBP sites were extremely valuable. IBP sites have government support in principle. He expressed concern about Fort Yukon Route intruding on IBP sites in the Yukon. Vol. 54
7435-7437

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b-8 Environmental Concerns - Alaskan Viewpoint

- Dr. Weedon listed environmental concerns pertaining to the various corridors.
- In respect to the Prime Route, Dr. Weedon listed the following concerns: impacts on birds and mammals, slow revegetation north of the Brooks range, large-scale gravel requirements, eventual disappearance of rare species, possibility of oil spills at three port sites, and three compressor stations, impingement on polar bear ranges and denning sites. Vol. 54 7474
- With respect to the Interior Route, Dr. Weedon said environmental concerns were: use of narrow valleys, wildlife impacts, open ditch impediment to caribou migrations, compressor station sites at Marsh Fork Valley and Old Woman Creek, effect on Dall sheep due to proximity of lambing areas, summer construction crossing of sheep trails and the fact that 50 per cent of Dall sheep winter close to the route. Vol. 54 7482
- Dr. Weedon listed the following concerns with respect to the Fort Yukon Corridor: duration of construction (2 winters) slope instability, steep mountain slopes, skin flows, permafrost degradation; crossing of several areas considered for inclusion into national conservation areas; Wind National Wild River area, Yukon-Charley National River Areas, the Porcupine National Forest and the southwest extension of the Arctic National Wildlife range. Vol. 54 7489
- The concerns listed for the Offshore Corridor were: ice hazards (even in lagoon areas) frost heave, erosion of coastal areas, oil spill hazards to polar bear, ringed seals, grizzlies and fish, impacts of three compressor stations and three ports, possible effect on key bird staging areas, effect on marine habitats for fish, effect of repeated use of low flying aircraft on bird life. Vol. 54 7497
- As to the Fairbanks Corridor, Dr. Weedon expressed concern about slope stability problems, construction in discontinuous permafrost, disturbance to wildlife and river crossing. Vol. 54 7513

b-9 Mountain Caribou

- Mr. Veale questioned Dr. Banfield on the number of mountain caribou. Dr. Banfield said there were 500 in the Kluane area close to the Fairbanks Corridor and groups of 100 in northern British Columbia.
- Dr. Geist said mountain caribou along the Fairbanks Corridor-Alaska Highway have already been disturbed. Vol. 54 7433
- Dr. Geist explained the basic differences between mountain caribou and barren ground caribou with larger size of mountain caribou and antler differentiation being the main distinguishing characteristics.

b-10 Arctic International Wildlife Range Proposal

- Dr. Andrew Thompson, Mr. Richard Collins and Dr. George Leonard, witnesses for CARC, provided the background of the International Wildlife Range proposal to extend the existing Arctic Wildlife Range (14,000 square miles) in Alaska to cover an area in the northern Yukon north of the Porcupine River to include the British Mountains, the Old Crow Flat, the Barn Mountains and a portion of the Yukon Arctic Coastal Plain. They outlined the wildlife and native populations, and physical characteristics of the proposed Range. Vol. 53
7272
- The position of the Arctic International Wildlife Society is not to take further steps in the creation of the range pending a disposition of land claims in the Yukon.
- The society position is that a pipeline routing away from the range is preferable, but, if it is necessary, that respect be shown for native uses and other important wilderness values.
- Under cross-examination by Arctic Gas, Dr. Leonard said the Secretary of the Interior can grant right-of-way through any United States federal reserves for pipeline purposes - subject to its being consistent with the purposes of the reserve. Vol. 53
7318
- Mr. Dau earlier, in a reply to questions from COPE, said foreclosure of the North Slope by creation of an International Wildlife Range would force Arctic Gas to use Interior Route rather than Offshore Route which would require a lot more study. Vol. 53
7081
- Mr. Hemstock said Arctic Gas believes a pipeline can be built across the Arctic Wildlife Range without seriously impacting the purpose of the range. Vol. 53
7044

b-11 Geotechnical Considerations

- Dr. Clark, witness for Arctic Gas, as a terrain specialist, indicated he was unable to give an opinion as to "best" route in a geotechnical sense. Vol. 54
6927
- Dr. Owen Hughes, Geological Survey of Canada, provided an overview of terrain conditions in the Yukon and Mackenzie Valley, outlining specific terrain problems. Vol. 53
7415-7428
- Dr. Hughes said terrain mapping was required along the Fairbanks and the Fort Yukon routes. Vol. 55
7430
- The applicant (Arctic Gas) has provided much less terrain and geotechnical data for the Fairbanks and Fort Yukon Corridors. Dr. Hughes said he was unable to make a detailed comparison between the proposed and alternative routes. Vol. 55
7428

b-12 Transportation Planning in Alaska

- Mr. Parker, CARC witness, said the future of transportation planning in Alaska rests upon two principal bases; the development of a general system of ports, highways, railroads and the air system to meet the needs of the resident population. Aims are maximum flexibility in meeting needs, efficient intermodal interfaces and substantial lowering of costs. Vol. 54
7517-7554

b-12 Transportation Planning in Alaska (Cont'd.)

- Mr. Parker then went on to outline environmental and construction problems associated with arctic and sub-arctic pipelines and roads thus far.
- Major environmental problems have been soil conditions and river crossings in the construction of the Alyeska pipeline and haul road. Vol. 54
7536
- Critical areas are those where a thaw envelope of a river system meets and merges with permafrost areas and where the pipeline emerges from river bottoms into stream terraces. Vol. 54
7537
- Material sites or borrow sites and spoil disposal sites for wasting are incompetent. Unusable soils create visual scars on the landscape. Rehabilitation in the Arctic is difficult. Mr. Parker suggested mining gravel in stream beds and flood plains be kept under rigorous discipline to maintain water quality, fish habitats and river regimes. To protect fish habitats, strict drainage control is necessary. Vol. 57
7538
Vol. 54
7540
- Mr. Parker said vapour releases in large quantities can create micro-climates which may impact visibility in harbours and airports. This problem has yet to be resolved at the Valdez Terminal and at the pump stations along the pipeline. Vol. 54
7541
- Mr. Parker said main failure in Alaska was not to develop earlier the type of surveillance organizations they have now at the Federal and State levels to plan alternatives. Fundamental corridor decisions were made before research in depth was accomplished. Vol. 54
7542-7543

C. Socio-Economicc-1 General

- The IBNWT questioned Mr. Trusty on socio-economic matters such as the impact of a pipeline on the alcoholism rate. Mr. Trusty said he had spoken to Dr. Hobart of the University of Edmonton about the subject. Vol. 53
7061
Vol. 53
7061
- The IBNWT asked what expertise was available to discuss family breakdown. Mr. Trusty said Arctic Gas was relying on consultants. The IBNWT suggested choice of alternative routes would permit time for settlement of native claims in the Northwest Territories. Mr. Trusty said settlement of native land claims was not taken into account during consideration of alternative corridors. Vol. 53
7061
Vol. 53
7063
Vol. 53
7065
- The IBNWT questioned Mr. Trusty on Arctic Gas statement, "without a major economic development the Mackenzie Valley Region faces a steady deteriorative for the present precarious economic and social situation". Mr. Trusty said there have been boom and bust effects, industry is scattered, there is a high unemployment rate in the Mackenzie Valley. Vol. 53
7068
Vol. 53
- Mr. Trusty said Alberta was an example of development following initial discovery and development of hydrocarbon resources. Vol. 53
7069

c-1 General (Con't.)

- Mr. Trusty said increased employment is a vehicle leading to other benefits, opportunity to fulfill expectations, opportunity for individuals to plan their lives to realize expectations. Vol. 53
7072
- Mr. Trusty did not agree with IBNWT assumption that influx of southerners would necessarily tend to undermine native way of life.
- In response to questions from COPE, Mr. Trusty said a road has more social impact than a pipeline. Vol. 53
7087
- In response to a question about depletion of community services by high pipeline wages, contracts, Mr. Trusty said he didn't think it would be the intention of Arctic Gas to drain local resources away from meeting community needs. Arctic Gas intends to provide its own facilities and services. Vol. 53
7124
- Mr. Trusty, under cross-examination by COPE, said it was his personal judgement that the employment creation possibilities of the project and spin-off effects would be more valuable in the Valley than they would be in the Yukon. Vol. 53
7127
- Mr. Trusty said the same camp policies as intended for Prime Route would apply along Fairbanks and Yukon Corridor. Vol. 53
7133
- Mr. Trusty said he thought Prime Route overall would be better from a socio-economic point of view than Interior Route.

c-2 Council for Yukon Indians Brief

- The Council for Yukon Indians brief presented by Mr. Joe Jacquot, David Joe and Mr. Alan Lueck, outlined the historical occupation and traditional use of the Yukon by Indian people, the disastrous effect of white developments (the Gold Rush, the Alaska Highway). Vol. 53
7176-7193
- The Council for Yukon Indians supported the Old Crow Indians in their plea for no pipeline either along Interior or Prime Routes. The Council for Yukon Indians expressed concern for physical and social destruction from pipeline saying they wanted land claims settlement so they would have their land. The Fairbanks - Whitehorse and Fort Yukon alternatives each pass through 5 of 12 native villages in the Yukon. The Council called for informal hearings in those villages, but said no permission for pipeline would be given until land claims were settled. The price was too high. The land claims settlement would permit Indians to develop an economy based on renewable resources.
- Reference was made to a government industry agreement on Anvil/Faro with respect to employing native people. It was pointed out the agreement had not worked.

c-3 Indian Brotherhood of N.W.T.

- Mr. James Wah-shee, appearing on behalf of the Indian Brotherhood of the Northwest Territories and the Métis Association of the Northwest Territories, said consideration of alternative routes put squarely before the Inquiry the possibility of avoiding using the Mackenzie Valley Route with all the resulting disruption of the life of the Dene. Vol. 53
7247

TRANSCRIPT
REFERENCE

c-3 Indian Brotherhood of N.W.T. (Con't.)

- Mr. Wah-shee made reference to Mr. Blair's statements to the effect his company would consider not building a pipeline before a land settlement. In turn he chided Arctic Gas for not considering land claims in section 14-E of their application on alternative corridors. Vol. 53
7248-7249
- Mr. Wah-shee said the social and environmental costs of the proposed Mackenzie Valley Gas Pipeline will be borne by Canadians and specifically by the native people of the Mackenzie District whom he represents. Vol. 53
7250
- He said Arctic Gas, by their own admission, had not properly considered moving Alaska gas alone to American markets, and queried whether it is not at least possible to do this without using the Mackenzie Route. Vol. 53
7252
- Mr. Wah-shee said that the Indian Brotherhood of the Northwest Territories welcomed the statement by the Minister of Energy of Alberta, as reported in the press, saying that Alberta would be willing to increase its supply of gas to central and eastern Canada and avert an immediate gas shortage, thus putting off the day when gas reserves from the Mackenzie Delta would be needed in southern Canada. This would permit more time to negotiate a land settlement. It would also permit time for a proper study of alternative routes. Mr. Wah-shee asked if the Government of Canada did not have an obligation to do so. Vol. 53
7253

c-4 Construction Workforce

- Arctic Gas stated construction workforce needed in Canada for Prime and Interior Routes was approximately the same. Differences in total workforce needed in Canada for Fairbanks and Fort Yukon Corridors may not be large but duration that total workforce is required is greater due to additional surveying, construction required with those two corridors. Vol. 52
6811

c-5 Secondary Employment

- Arctic Gas stated secondary employment would be about equal for the construction phase of the pipeline along the Prime Route, Offshore Corridor and Interior Route and slightly greater for the Fairbanks and Fort Yukon Corridors. Vol. 52
6814

c-6 Native Population Along Corridors

- Arctic Gas stated more native people are located along the Prime and Interior Routes than along the Fairbanks and Fort Yukon Corridors. Vol. 52
6812

c-7 Impact of Pipeline Activities on Glenallen

- Mr. Sprecker, Alaskan magistrate and witness for the CYI outlined the impacts of Alyeska pipeline construction activities on Glenallen, a small Alaskan community on the Richardson Highway. Vol. 53
7176-7246
- He described the dramatic population increase resulting from pipeline activities in Glenallen (400 in 1965 to 6,000 in 1974) heavy traffic

c-7 Impact of Pipeline Activities on Glenallen (Cont'd.)

increase and rise in traffic cases, increase in hospital cases as a result of overload from pipeline camps. He noted a rise in alcohol-related offences with a tremendous impact on family life and a resulting increase in social problems.

- American unions had overruled Alyeska with a subsequent congestion of pipeline workers' families in Glenallen, and pipeline workers having firearms and drugs in camps.

c-8 Archaeological Sites

- Dr. R.E. Morlan, archaeologist and CARC witness, said the Interior Route poses a threat to more known archaeological sites than the Prime Route. He listed the following sites: Kloo-Kut, Rat Indian Creek, La Pierre House, an unnamed site seven miles west of the crest of the Richardsons and the confluence of the Old Crow and Porcupine Rivers. Vol. 55
7431-7453
- Along the Prime Route he cited the immediate vicinity of the Firth River, the Engigstciak site, Malcom River and Rapid Creek.
- Along the Fort Yukon Route he said the exact threat is not known but there are thirty sites along the Klondike Highway primarily at stream crossings.
- There was a need for a detailed reconnaissance along the Fairbanks Route but in terms of pipeline impact it offered the least threat to prehistoric heritage of the Territories.

c-9 Miscellaneous

- Dr. W. Banfield suggested a cross-examination format was not a suitable means of exploring a witness's experience and criticized "canned evidence" as part of the methodology used in the Inquiry process. Vol. 55
7467
Vol. 55
7470

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUME NO. 68)

CANADIAN ARCTIC GAS - ALTERNATIVE CORRIDORS

COSTS

Yellowknife, N.W.T.

September 24, 1975

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a-1 Alternative Route Costs	244

TOPIC: Phase 1: Engineering and Construction of the Proposed Pipeline

Panel of Arctic Gas on Alternative Corridors
(recalled)

DATE: September 24, 1975 in Yellowknife

WITNESSES: Arctic Gas Panel consisting of:

P.H. Dau: President, Northern Engineering Services
(NES)

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Engineering/Technical

a-1 Alternate Route Costs

- During the Whitehorse hearings dealing with alternative pipeline routes, Foothills requested, and the Judge ruled, that Arctic Gas produce comparative cost figures on the alternate routes by segment (see transcript pages 6960 and 7059). Mr. Dau explained that because of a problem in assessing the indirect (financing) costs per segment, it was only possible to provide those costs by pro-rating the total project indirect cost to each segment on the basis of its direct cost. The problem is that there are 10 or 11 financing plans and the existing computer program can't pro-rate the costs except as noted. The Judge directed that the cost be provided on this basis.

Vol. 68
10170-10171
10174-10179
10182-10183

Policy and Planning
(ACND) Division
October 12, 1975.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGSALTERNATIVE ROUTESCANADIAN ARCTIC GAS WITNESS - CROSS-EXAMINATION

(TRANSCRIPT NO.91)

YELLOWKNIFE, N.W.T.

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a - 2 Miscellaneous	246

TOPIC: Phase I: Engineering and Construction of the Proposed Pipeline

Alternative Routes

DATE: November 20, 1975 in Yellowknife

WITNESS: Canadian Arctic Gas witness:

- P.H. Dau: President, Northern Engineering Services Ltd. (NES)

* NOTE: This summary contains the cross-examination on evidence led in Whitehorse on August 11 to 15 by Mr. Dau.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 Gas Cost Comparison: Fairbanks and Prime Routes

- The 1984 cost of Alaskan Gas at the 49th parallel, if the Delta leg of each of the routes is ignored, would be \$1.14/million BTU's using the prime route compared to \$1.11/million BTU's using the Fairbanks route, according to Foothills in cross-examination of Mr. Dau. The step by step development of this calculation was made by Foothills using the figures supplied by Arctic Gas in their application and segmented cost breakdown figures (exhibit 287). Mr. Dau agreed with the calculation methodology but suggested that the comparison was not valid because the throughput would be different for each system even though both would be 48-inch diameter pipelines. Foothills suggested that the figures show that there is not any significant difference in cost to the American consumer using the Prime or Fairbanks routes and evidence has been heard that the Fairbanks route is more environmentally acceptable. It also leaves the North Slope area untouched. Vol. 91 13845-13880
- The Fairbanks route is 300 miles longer than the proposed Prime route and \$1.4 billion more expensive to build, according to Mr. Dau in cross-examination by Commission Counsel and in re-direct by Arctic Gas. If the Prime route pipeline were built for only Alaskan gas, it would be cheaper to loop it to handle Delta gas than to build an entirely new line to carry the Delta gas as would be required if the Fairbanks route were used. Vol. 91 13892-13898

a-2 Miscellaneous

- The inflation factor incorporated in the cost estimates was questioned by the Judge. Vol. 91 13888-13892

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(Transcript Volumes Nos. 77 and 78)

CARC WITNESSALTERNATIVE CORRIDORS

Yellowknife, N.W.T.
October 22 and 23, 1975

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TOPIC: Phase 1: Engineering and Construction of the Proposed Pipeline

Alternative Corridors in the N.W.T.

DATE: October 22 and 23, 1975 in Yellowknife.

WITNESS: CARC witness:

Dr. M.A. Roed: President, Geoconsult Ltd.

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 General

- The East of Franklins route has the best terrain advantages of the three alternative corridors in the area, according to Dr. Roed. The other two corridors are the East of Shield Corridor and the Mackenzie Valley Corridor. The Mackenzie Valley is the most inappropriate place to build a pipeline while the East of Shield route is the best for long-range development and would be strategically located for future oil and gas discoveries in the Beaufort Sea-Banks Island areas. Vol. 77
11485-11487
11464-11466
- The model terrain conditions for a corridor development were described by Dr. Roed, along with the three planning stages involved in a corridor assessment. In cross-examination by Commission Counsel, Dr. Roed said that all the factors described in his planning technique were given equal weight. Aesthetic potential and wilderness factors were not considered. Vol. 77
11452-11458
11463-11464
Vol. 77
11458-11463
Vol. 78
11575-11579
- The corridor evaluation was based on terrain features and mineral potential of the three areas only, according to Dr. Roed in cross-examination by Foothills. A granular survey of the East of Franklins route was done by Geoconsult which showed abundant sand and gravel compared to the Mackenzie Valley. No pipeline contractors' views were obtained on the various routes. Vol. 78
11504-11513
11526-11530
- The "follow-the-leader" tendency of development would apply to a gas pipeline if it were to be built, according to Dr. Roed in cross-examination by Arctic Gas. Arctic Gas suggested that the Mackenzie Valley was already an established corridor. Dr. Roed said that the Valley was inappropriate compared to the East of Franklins and Edge of Shield routes where the resource potential was better. The best overall corridor would be the Edge of Shield proposal. In cross-examination by Commission Counsel, Dr. Roed said that there was nothing inherent requiring one development to follow another. The Mackenzie Valley may be developed, but from a terrain sensitivity and resource potential viewpoint it is not appropriate. Commission Counsel suggested that Dr. Roed's two alternative corridors couldn't be compared to the Mackenzie Valley without considering what facilities already exist in the Valley. Vol. 78
11533-11537
Vol. 78
11566-11575

TRANSCRIPT
REFERENCE

- The "Y-pipeline route" which would see an extended Delta pipeline join a Polar Gas pipeline near Chesterfield Inlet is currently under study by Government but this type of proposal emphasizes the need for a complete overview of potential land use in the Arctic, according to Dr. Roed in cross-examination by ITC/COPE. The Y route transects the natural geological features in the worst possible way. Vol. 78
11496-11504

a-2 East of Franklins Route

- The East of Franklins Corridor begins at Sitidgi Lake and runs south-east through the saddle of the Colville Hills and to the west of the Smith Arm of Great Bear Lake then to the south-east of Keller Lake and the Horn Plateau to cross the Mackenzie River near Fort Providence, according to Dr. Roed. The terrain along the route was described along with an explanation of the terrain advantages of fluted moraines. Vol. 77
11475-11483
- The flutes on the East of Franklins route are an excellent place to build a pipeline, according to Dr. Roed in cross-examination by Arctic Gas. These flutes extend for about 60 per cent of the route. There is considerably less sensitive terrain on this route compared to the Mackenzie Valley pipeline route as proposed. Vol. 78
11548-11566
- The till ridges and the avoidance of the many stream crossings of the Mackenzie Valley are advantages of the East of Franklins Corridor, according to Dr. Roed in cross-examination by Commission Counsel. The fluted terrain features become more subdued in the southern part of the corridor but north of Willowlake River the Franklins route is superior to the Valley route. The East of Franklins route previously discussed by Dr. Rutter is west of this East of Franklins corridor.

a-3 Edge of Shield Route

- The Edge of Shield Corridor would start at the geographic centre of the Mackenzie sedimentary basin on the Tuktoyaktuk Peninsula and extend in a straight line 850 miles south-east to near Port Smith on the N.W.T. - Alberta border, according to Dr. Roed. The terrain was described on a segment-by-segment basis. In cross-examination by ITC/COPE, Dr. Roed said that there are good mineralization possibilities along this route and it overlaps high probability gas discovery areas. Vol. 77
11466-11475
- The existing pipeline facilities in the Northern provinces which could be utilized by a Mackenzie Valley pipeline would be by-passed if the Edge of Shield route were used, according to Foothills in cross-examining Dr. Roed. The route to be followed south of Great Slave Lake was described by Dr. Roed. He said he had talked to Parks Canada people on routing a pipeline down the boundary of Wood Buffalo Park. Environmental factors were considered only indirectly. The route would go around the Blue Nose Caribou herd in the area north of Great Bear Lake. Vol. 78
11513-11518
- The segment-by-segment terrain analysis of the route was cross-examined by Arctic Gas who emphasized the lack of ground truth data. Vol. 78
11537-11544

TRANSCRIPT
REFERENCE

- The crossing of Great Bear and Great Slave Lakes would be in less than 300 feet of water but details of the lake bed contours and materials are unknown, according to Dr. Roed in cross-examination by Foothills. The construction costs of these crossings were not known to Dr. Roed but Foothills suggested they could be three times that of an on-land pipeline. In cross-examination by Arctic Gas, Dr. Roed said he could not pass judgement on the best submarine construction technique since he had just done a feasibility overview. In cross-examination by Foothills, the material assembled as part of the feasibility overview was described.

Vol. 78
11518-11520

Vol. 78
11544-11548

Vol. 78
11490-11495

a-4 Logistics

- The logistics of the two alternative corridors could pose a major problem, according to Dr. Roed, but the East of Franklins route could still use the Mackenzie River with staging areas near Fort Providence, Great Bear River, the Bennett Field airstrip near Loon River, and at Inuvik. Foothills asked that the backup material on logistics be provided so they could examine it more closely. In cross-examination by Arctic Gas, Dr. Roed said that logistics on both his corridors would be more difficult than for the Mackenzie Valley corridor. The increased costs associated with these difficulties were accounted for in a general way in the evaluation.

Vol. 77
11483-11484

Vol. 78
11523-11526

Vol. 78
11563-11564
- Three major staging points to supply the East of Franklins route would be sufficient, according to Dr. Roed in cross-examination by Commission Counsel. The Edge of Shield route would provide access to the Edge of Shield mineralization area which is a band about 200 miles wide.

Vol. 78
11581-11586

a-5 Miscellaneous

- Foothills advised that it would not be calling any evidence on alternative corridors and routes. They expressed the view that the obligation on the Inquiry to investigate these matters, as outlined in the guidelines, has been satisfied. The Judge suggested that this could be the case and asked the participants to consider the view expressed by Foothills.

Vol. 78
11596-11609

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(Transcript Volume No. 76)

ALTERNATIVE CORRIDORSCARC WitnessYELLOWKNIFE, N.W.T.
October 21, 1975

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TOPIC: Phase 1: Engineering and Construction of the Proposed Pipeline

Alternative Routes

DATE: October 21, 1975, in Yellowknife

WITNESS: CARC Witness:

Dr. O. Hughes: Geological Survey of Canada

NOTE: This summary contains only the cross-examination of Dr. Hughes

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 Permafrost

- Thermocarst depressions in the Northern region which are already frozen would not offer the problems associated with frost heave but would still exhibit problems of slope stability in their walls, according to Dr. Hughes in cross-examination by Arctic Gas. Vol. 76
11298
- The major parts of Fairbanks corridor in the Yukon would be south of the area of permafrost problems, according to Dr. Hughes in cross-examination by Commission Counsel. Vol. 76
11298-11306

a-2 Terrain Characterization

- It is not enough to divide terrain into types - each type should be characterized to give a full appreciation of its properties, according to Dr. Hughes in cross-examination by Commission Counsel. Such a characterization would include investigation of each terrain type for properties such as: layers, form and distribution of permafrost, ground ice occurrence, surface and subsurface drainage, erosion vegetation, slope incidence etc. The practical limit to bore hole programs makes this type of approach essential in assessing potential problems. It also leads to the decision on where to make the drill hole investigation. Vol. 76
11306-11328

a-3 Termination of Chilling

- The steps which would lead to a decision on where to terminate chilling for terrain reasons, were outlined by Dr. Hughes at the request of Commission Counsel. The steps were: (1) assess which terrain types constitute most of the route between Willow Lake River and the Alberta border, (2) obtain a terrain characterization of each, (3) have soils engineers predict the consequence of a chilled and a warm line in each on the basis of the characterizations, (4) have environmentalists weigh the consequences of the predicted events, (5) sum up the mileages of each terrain type with the associated adverse or beneficial effects of each mode and thereby assess the change-over point. Vol. 76
11328-11336

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(Transcript Volume No. 77)

Alternative corridorsCARC WitnessYELLOWKNIFE, N.W.T.
October 22, 1975

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TOPIC: Phase 1: Engineering and Construction of the Proposed Pipeline

Alternative Routes - East of Franklin

DATE: October 22, 1975, in Yellowknife

WITNESS: CARC Witness:

Dr. N.W. Rutter: Associate Professor of Geology,
University of Alberta

TRANSCRIPT
REFERENCE

HIGHLIGHTS

A. Technical/Engineering

a-1 General

- The geological terrain evaluation work of a broad Mackenzie corridor was described by Dr. Rutter in Chief. This work was published as part of the government Environmental-Social Program series. The study area was divided into four map areas: (1) Kakisa River and Trout Lake; (2) Fort Simpson and Sibbeston Lake; (3) Fort Simpson, Sibbeston Lake, Camsell Bend and Bulmer Lake and (4) Camsell Bend and Wrigley. The geology and geomorphology of each of the areas was described. The major pipeline related terrain hazards encountered in the study areas are: (1) fine grained sediments subject to frost heave, (2) thick organic deposits, (3) areas with high rates of surface run-off and, (4) river crossings. The best pipeline route falls within areas 1, 2 and 3 as it is proposed but outside area 4 where the best route goes East of the Franklin Mountains. Vol. 77
11347-11356

- The area where the East of Franklins route would diverge from the Arctic Gas route would be between Willow Lake River and Blackwater River, according to Dr. Rutter in cross-examination by Arctic Gas. North of the Blackwater River was outside the study area and should be investigated further. Vol. 77
11379-11392

- Further research and study of the route should be carried out and enough information exists to do an office evaluation, according to Dr. Rutter in Chief and in cross-examination by N.W.T. Indian Brotherhood/Métis Association. Dr. Rutter suggested to the Judge that the route was not investigated by the applicants because of: (1) the economic advantage of being close to the river, (2) the announcement of the Mackenzie Valley Highway route and (3) the wishes of the Federal Government. Arctic Gas pointed out: (1) there would be greater construction costs and logistics problems on the East of Franklins route, (2) the adverse environment impact of access roads over the mountains, (3) terrain problems on the proposed route could be handled and (4) the proposed route is shorter. Vol. 77
11369-70
11378-11379

Vol. 77
11370-11372

Vol. 77
11372-11378

- The "corridor" referred to in the testimony is an area defined by the map areas 1 to 4 (as described above) and as such is a self-defined corridor, according to Dr. Rutter in cross-examination by Commission Counsel. Vol. 77
11421-11423

HIGHLIGHTSTRANSCRIPT
REFERENCEa-2 Terrain

- Characterization of the terrain units, as suggested by Dr. O. Hughes is a vital part of the terrain analysis process, according to Dr. Rutter in cross-examination by Commission Counsel. It would not be prudent to proceed with construction without such detailed characterization. Vol. 77
11417-11421
11437-11442
- The best pipeline route on the basis of terrain suitability is to the East of the Franklins, according to Dr. Rutter. The most significant surficial deposits of the route were described. In cross-examination by Foothills, Dr. Rutter said that there was no drill hole data to back up this view but the surficial features led to the conclusion that the east of Franklins route was superior. In cross-examination by Arctic Gas, Dr. Rutter pointed out that the east of Franklins route, in addition to having better terrain for a pipeline, has a better gravel supply and fewer major river crossings. Vol. 77
11356-11368
Vol. 77
11392-11403
11410-11417
Vol. 77
11403-11410
- About 80 per cent of the east of Franklins route would be on ice-free well drained soils, according to Dr. Rutter in cross-examination by Commission Counsel. There would be no advantage to the route, however, unless work north of the study area confirmed the routes superiority. There is much less data on the east of Franklins route than on the route proposed. Vol. 77
11423-11435

a-3 Ebbutt Hills

- Terrain damage could be controlled whether the pipeline goes over the Ebbutt Hills, as proposed by GAGPL, or around them, as proposed by Foothills, according to Dr. Rutter. In cross-examination by Commission Counsel, Dr. Rutter said that slope failure in that area would be a minor problem depending on the construction techniques. Vol. 77
11368-11369
Vol. 77
11435-11436

B. Environmental

- Nil

C. Socio-Economic

- Nil

D. Miscellaneous

- In his capacity as environmental advisor to the NEB in 1974-1975 he did not provide advice on routes, according to Dr. Rutter in response to the Judge's questioning. Vol. 77
11403

E. Inquiry Schedule

- The proposed schedule for the first part of the new year was given by Commission Counsel as follows: Vol. 77
11339-11342

January

- 12-23 Formal and Informal hearings in Inuvik on the cross-Delta route and the producer's facilities.
- 26-30 No hearings.

February

- 2-13 Formal and Informal hearings in Inuvik on the
cross-Delta route and the producers facilities.
- 16-20 Northern Community hearings.
- 23-27 No hearings.

March

- 1-5 Northern community hearings.
- 8-16 Formal hearings in Yellowknife.

Policy and Planning
(ACND) Division
November 12, 1975

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 75 AND 76)

ALTERNATIVE ROUTESCARC Witness CrossexaminationOCTOBER 20 AND 21, 1975YELLOWKNIFE, N.W.T.

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TOPIC: Phase I: Engineering and Construction of the Proposed Pipeline

Alternative Routes

DATE: October 20 and 21, 1975 in Yellowknife

WITNESSES: CARC witnesses:

- Dr. R. Weedon: Director, Policy and Planning, Governor's Office, State of Alaska.
- Mr. W. Parker: Commissioner of Highways, State of Alaska.

NOTE: Dr. Weedon and Commissioner Parker gave their evidence in chief in Whitehorse in August.
This summary is of the cross-examination only.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 General

- The State of Alaska does not totally accept the chilled gas pipeline concept for all soil conditions, according to Commissioner Parker in cross-examination by the Council for Yukon Indians (CYI). Vol. 75 11095-11098 Vol. 76 11186-11187
- The winter construction program on the Alyeska pipeline has been cut back because of cold weather construction restraints said Commissioner Parker in cross-examination by ITC/COPE. This reduction involves decreasing the labour force from 22,000 to 6,000. Vol. 76 11228-11232 11249-11251
- The cost of the Alyeska pipeline was originally estimated at \$900 million when total burial was proposed but the current estimates are \$6.3 billion, according to Commissioner Parker in response to the Judge's questions. The Alyeska elevated construction mode was chosen because the engineers could not demonstrate a satisfactory method of burial. Vol. 76 11206-11210
- The Judge said it was his understanding that the cost of the Mackenzie Valley route in Canada would be about \$7 billion while the in-Canada portion of the Fairbanks route would be about \$8 billion. The total cost of the Arctic Gas system in both the U.S. and Canada is \$7.9 billion while the total Fairbanks route cost would be \$10.9 billion.

B. Environmental

b-1 General

- The views expressed in the testimony reflect those of the State of Alaska as well as the Federal Bureau of Land Management (as contained in their Environmental Impact Report), according to Dr. Weedon in cross-examination by Arctic Gas. The state Attorney General's report to the Governor is not complimentary to either route on a mile by mile basis. Vol. 75 11035-11045

TRANSCRIPT
REFERENCE

b-1 General (Cont'd)

- A forthcoming State report will deal with the problem of a chilled gas pipeline across State lands including the problem of frost heave, according to Commissioner Parker in cross-examination by Arctic Gas. Mr. Parker went on to explain that revegetation north of the Brooks Range was currently under study. Vol. 75
11080-11083
11088-11090
- Vegetation can be used as an ecosystem indicator, according to Dr. Weedon and Commissioner Parker in cross-examination by Arctic Gas. Vol. 75
11048-11050
- The water requirements for the Arctic Gas project have not been quantified relative to supply, according to Dr. Weedon in cross-examination by Arctic Gas. Vol. 75
11099-11104
- The flood plain gravel sites are preferred to the upland sites by the State of Alaska because there are less environmental impacts, according to Commissioner Parker in cross-examination by Arctic Gas. The techniques of gravel extraction from river plains were described by Commissioner Parker. Vol. 76
11162-11166
- Spill of petroleum products such as methanol used in testing, or anti-freeze, during the construction phase, is a concern expressed in the Bureau of Land Management's Impact Statement, according to Commissioner Parker in cross-examination by ITC/COPE. A list of such substances used in construction is required on the Alyeska project before a Notice to Proceed is given. Vol. 75
11126
Vol. 76
11224-11228

b-2 Corridors/Routes

- The State of Alaska opposes the route across the North slope according to Dr. Weedon in response to the Judge's questions. The existing north-south corridor is preferred, according to Commissioner Parker. It exists for the oil pipeline and the infrastructure is there to serve a gas pipeline. The environmental problems have been thrashed out and this knowledge can be applied to subsequent projects. Soils information will be more detailed and the hydrology is better understood. It is logical to keep within the established corridor when the origins and modes are so similar. It is the State's judgement that the impact of two parallel pipelines would be less than if there were two separate corridors. This judgement is based on all the information available to the State to date. Common corridors are most important so that disturbance to wilderness areas is avoided. Vol. 75
11035-11045-
11048-11076-
11077-11127-
11129-11136-
11141
Vol. 76
11144-11162
11166-11169
11169-11179
- Pet. #4 (west of Prudhoe Bay) is committed to massive development by the U.S. Navy, according to Commissioner Parker in response to the Judge's questions. This, along with Arctic Gas plans to build their pipeline east, has increased the State's emphasis on comprehensive planning. Planning involves Federal, State and local levels of government. Vol. 75
11073-11079
11062-11063

TRANSCRIPT
REFERENCE

b-2 Corridors/Routes (Cont'd)

- There is no engineering reason why the Fairbanks corridor gas pipeline couldn't follow the highway, according to Commissioner Parker in cross-examination by the CVI. Highway transport would be superior to barge transport during construction from a reliability and frequency of access viewpoint. Gravel and water are available on the Fairbanks corridor in quantities comparable to, or better than, other routes.
- The corridor concept is no excuse for bad engineering, according to Commissioner Parker in cross-examination by Commission Counsel. If carried to extremes the concept could lead to placing facilities in the wrong place. Transportation for people and resources depends on the location of population centres, the point of origin of resources and marketing destinations. In Alaska the idea is to make maximum use of the north-south corridor and limit the east-west access until absolutely necessary. The corridors generally follow natural geographic features and this often interferes with strict corridor ideas.

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b-3 Arctic National Wildlife Range

- A permanent road would probably be required by Arctic Gas along the North Slope despite what they claim, according to Dr. Weedon in cross-examination by Arctic Gas. The Range area has good potential for oil and gas, and drilling might be allowed if Arctic Gas crossed the area as the wilderness character would be lost and a second intervention wouldn't hurt more. The Range is not now a Wilderness Area and a gas pipeline is therefore not prohibited by law. The designation of the area as Wilderness is up to Congress. At present the Secretary of the Interior can still permit the use of the Range for a gas corridor.
- If Congress acts and designates the area as a Wilderness Area that would foreclose any options regarding pipelines, etc., now open to the Secretary, according to Dr. Weedon and Commissioner Parker in cross-examination by Commission Counsel. The 3 mile offshore area is owned and controlled by the State. Commission Counsel suggested that if the State were intent on maintaining the area as Wilderness they would enact restrictive legislation in the offshore area where they have jurisdiction, since development in that area would have to be limited in order to maintain the onshore wilderness area. Commissioner Parker pointed out that it is U.S. federal policy to develop oil and gas wherever it is found. This is not the policy of the State of Alaska which insists that living resources will have priority wherever they are critical or subcritical. Dr. Weedon pointed out that the offshore battle involved the entire Continental Shelf in the Gulf of Alaska and elsewhere, and this battle would be dealt with when it arose.

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11120-11121

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TRANSCRIPT
REFERENCEb-3 Arctic National Wildlife Range (Cont'd)

- Two years of observations on the effects of the pipeline on polar bears is flimsy evidence upon which to base an impact theory, according to Commissioner Parker. Vol. 75
11090-11095
- The impact of spills and noise on North Slope animal and bird populations was based on the draft Environmental Impact Statement by the Bureau of Land Management, according to Dr. Weedon in cross-examination by Arctic Gas. Vol. 75
11121-11126
11130-11131

b-4 Caribou

- The development triggering effect of a pipeline in the Porcupine caribou herd area is of major concern to the State, according to both Dr. Weedon and Commissioner Parker in cross-examination by Arctic Gas. The effect of the Prudhoe Bay gathering lines on caribou access to the fly-free coastal areas is not yet known. The State doesn't want all the North Slope area committed without observing this effect. Historically, increased activity in an area with the associated increase in access, hunting, overflights and noise are known to affect caribou. The views of Arctic Gas consultants are not shared by all. During construction, aerial activity is very intense until ground support facilities are in place. This type of activity may lead to the abandonment of traditional calving grounds. Vol. 75
11060-11061
11063-11073
- The impact on the caribou of the Fairbanks corridor would be less than the Coastal or Interior routes, according to Commissioner Parker in cross-examination by the CYI. The impact of highway development on a herd was described by Dr. Weedon using the 40 mile herd and the Steese Highway built in 1928 as an example. In any development, the planning must be done not for the present herd but for the historical herd. Vol. 76
11198-11206
- The net result of the Arctic Gas proposed routing and the developments that would follow would be detrimental to the caribou, according to Dr. Weedon in cross-examination by Commission Counsel. Although the Arctic Gas project itself may have only a modest impact, further oil and gas development is of real concern. The maximum impact of the Arctic Gas proposal would come from compressor stations and summer operation and maintenance activities. Development would primarily affect caribou in: (1) their ability to calve and (2) the size of their range by physical obstruction. The prime route proposed by Arctic Gas would have the most adverse effect followed by the Interior and Fort Yukon routes in that order. Vol. 76
11251-11262

b-5 Transportation

- The snow road idea, as proposed by Arctic Gas, is not operationally proven and needs more work to prove that snow roads can stand up to heavy equipment use, according to Commissioner Parker. A brief outline of snow road use in Alaska was given. Commissioner Parker then described the use of "thin winter work pads" in Alaska. These are 18 inch pads placed on the tundra in the winter for winter use. They are abandoned in the summer. The object is to save gravel resources. Vol. 75
11026-11034

TRANSCRIPT
REFERENCE

b-5 Transportation (Cont'd)

- The use of the Alyeska haul road by up to two hundred trucks per day has led to substantial maintenance problems with the associated increase in maintenance costs. The road is maintained during the day with traffic limited to night time use. The State did the right thing by loading the cost of this operation on the Alyeska project. Vol. 76
11196-11198
- The Fort Simpson to Fort Nelson winter road could be used to move freight to a Mackenzie Valley pipeline, according to Commissioner Parker in cross-examination by the NWT Indian Brotherhood/Métis Association and Foothills. Vol. 76
11219-11224
11249

C. Socio-Economic

c-1 Land Claims

- A brief history of the events which led to the settlement of the Alaskan Native land claims issue was given by Commissioner Parker at the request of the NWT Indian Brotherhood/Métis Association and the Judge. The settlement resulted in the formulation of 12 Native Corporations and Village Corporations which are now active in refining their land selection. The Secretary of the Interior instituted a land freeze in 1966 and amplified it in 1968. In 1969 he withdrew two pipeline corridors to ensure that Native or State land selection wouldn't jeopardize the national welfare. When the corridors were accepted law suits against the pipeline company and Interior began. In December 1973 Congress ordered that the lease and right-of-way be granted declaring that the National Environmental Protection Act was satisfied and thereby removed the project from further action. The land freeze was the club used to settle the land claims. Senator Jackson, as Chairman of the Interior Committee, moved to resolve the issue as soon as possible. It was possible to consider the routing and resolve the land claims issue at the same time. If the pipeline routes were to change now, the land owners on the new route would have to be compensated. The limited public hearings for the Alyeska project were described. Vol. 76
11211-11219
- The land freeze was the club used to settle the land claims. Senator Jackson, as Chairman of the Interior Committee, moved to resolve the issue as soon as possible. It was possible to consider the routing and resolve the land claims issue at the same time. If the pipeline routes were to change now, the land owners on the new route would have to be compensated. The limited public hearings for the Alyeska project were described. Vol. 76
11241-11246

c-2 Labour Force - Alaska

- The Native people now represent less than 20% of the total State population, according to Commissioner Parker in response to the Judge's questions. Most are employed by the Native Corporations under sub-contract to Alyeska. This helps to get around union problems and seems to be preferred by the Native people. The unions have relaxed their closed-shop rules somewhat as an act of good faith toward Native peoples. Vol. 76
11232-11238
- Removal of workers for rest and relaxation periods is restricted by the rights of individuals under the Constitution, according to Commissioner Parker in cross-examination by ITC/COPE. Under the law the company can only give the worker a ticket to wherever he wants to go and deny him camp facilities. Dr. Weedon recommended that if possible the worker be required to go south. This would mean that families would be left in the south and thereby decrease the social "costs". Vol. 76
11238-11241

TRANSCRIPT
REFERENCEc-3 Cost Sharing: State of Alaska - Alyeska

- The surge of costs to public agencies fall on the government before there are revenues to offset them, according to Dr. Weedon. The State paid out \$30 to \$33 million beyond normal revenue sharing to help cope with pipeline impact problems. Local communities also increased their taxes. Commissioner Parker said that Congress has been asked for another \$300 million over five years just to upgrade existing highways because of increased traffic. The Alyeska haul road (to the North Slope) was built at Alyeska's expense and will be turned over to the State when the project is completed. The cost was about \$250 million. The State pipeline office, the federal surveillance, the highway costs are charged back to Alyeska. Annual State chargebacks amount to about \$4 million while the Federal share is about \$7 or \$8 million.

Vol. 76
11187-11196Policy and Planning
ACND Division
November 24, 1975.



1-7378

COMMISSIONER APPOINTED FOR MACKENZIE VALLEY PIPELINE
INQUIRY

Ottawa (March 22, 1974) -- The Honourable
Mr. Justice Thomas Rodney Berger of the British Columbia
Supreme Court has been named Commissioner of the
Mackenzie Valley Pipeline Inquiry by the Minister
of Indian and Northern Affairs, Jean Chrétien.

The appointment is in accordance with Mr. Chrétien's statement that upon the receipt of an application for the right-of-way to construct a gas pipeline up the Mackenzie Corridor, the application would be subjected to a detailed examination to ensure that it met with the conditions for northern pipeline construction as outlined in Expanded Guidelines for Northern Pipelines, tabled in the House of Commons, 1972.

Born in 1933 in Victoria, B.C., Justice Berger received his legal education at the University of British Columbia and was called to the Bar in 1957. He practised general law in Vancouver until his appointment to the British Columbia Supreme Court in 1971, at the age of 38.

Previously, his practise included criminal law, labour law and constitutional cases, including representation of Indian people.

In 1965, in the case of Regina v. White and Bob he successfully argued a test case before the Supreme Court of Canada on behalf of the Indians of Vancouver Island, upholding their hunting rights under a series of treaties made a century before.

In November 1971, Justice Berger argued the case of Calder v. Attorney General of British Columbia (the Nishga case) in the Supreme Court of Canada. While the Judges upheld the view that the Indian people of British Columbia had aboriginal title to the province at the time of the coming of the white man, they were equally divided on the question as to whether or not this title had been extinguished by competent legislation in the meantime.

At present he is the Chairman of the British Columbia Royal Commission on Family and Children's Law.

Justice Berger was the New Democratic Party Member of Parliament representing the Vancouver Burrard riding in 1962-63; N.D.P. Member of the Legislative Assembly for the same riding from 1966-69. He was Leader of the provincial New Democratic Party in 1969, after which he returned to his law practise until his appointment to the British Columbia Supreme Court in December, 1971.

Since going on the bench he has been invited to speak at the University of British Columbia, University of Alberta, and University of Saskatchewan, in the field of administrative law, native rights, civil liberties, and corporation law.

The attached is a copy of the Order-in-Council designating the Honourable Mr. Justice Thomas R. Berger as Commissioner of the Mackenzie Valley Pipeline Inquiry, under the provisions of the Territorial Lands Act; also his terms of reference.

(Appendix to release number 1-7378 dated March 22, 1974)



P.C. 1974-641
21 March, 1974

PRIVY COUNCIL • CONSEIL PRIVÉ

1-7378B

WHEREAS proposals have been made for the construction and operation of a natural gas pipeline, referred to as the Mackenzie Valley Pipeline, across Crown lands under the control, management and administration of the Minister of Indian Affairs and Northern Development within the Yukon Territory and the Northwest Territories in respect of which it is contemplated that authority might be sought, pursuant to paragraph 19(f) of the Territorial Lands Act, for the acquisition of a right-of-way;

AND WHEREAS it is desirable that any such right-of-way that might be granted be subject to such terms and conditions as are appropriate having regard to the regional social, environmental and economic impact of the construction, operation and abandonment of the proposed pipeline;

THEREFORE, HIS EXCELLENCY THE GOVERNOR GENERAL IN COUNCIL, on the recommendation of the Minister of Indian Affairs and Northern Development, is pleased hereby, pursuant to paragraph 19(h) of the Territorial Lands Act, to designate the Honourable Mr. Justice Thomas R. Berger (hereinafter referred to as Mr. Justice Berger), of the City of Vancouver in the Province of British Columbia, to inquire into and report upon the terms and conditions that should be imposed in respect of any right-of-way that might be granted across Crown lands for the purposes of the proposed Mackenzie Valley Pipeline having regard to

- (a) the social, environmental and economic impact regionally, of the construction, operation and subsequent abandonment of the proposed pipeline in the Yukon and the Northwest Territories, and
- (b) any proposals to meet the specific environmental and social concerns set out in the Expanded Guidelines for Northern Pipelines as tabled in the House of Commons on June 28, 1972 by the Minister.

HIS EXCELLENCY THE GOVERNOR GENERAL IN COUNCIL
is further pleased hereby

1. to authorize Mr. Justice Berger

- (a) to hold hearings pursuant to this Order in Territorial centers and in such other places and at such times as he may decide from time to time;
- (b) for the purposes of the inquiry, to summon and bring before him any person whose attendance he considers necessary to the inquiry, examine such persons under oath, compel the production of documents and do all things necessary to provide a full and proper inquiry;
- (c) to adopt such practices and procedures for all purposes of the inquiry as he from time to time deems expedient for the proper conduct thereof;
- (d) subject to paragraph 2 hereunder, to engage the services of such accountants, engineers, technical advisers, or other experts, clerks, reporters and assistants as he deems necessary or advisable, and also the services of counsel to aid and assist him in the inquiry, at such rates of remuneration and reimbursement as may be approved by the Treasury Board; and

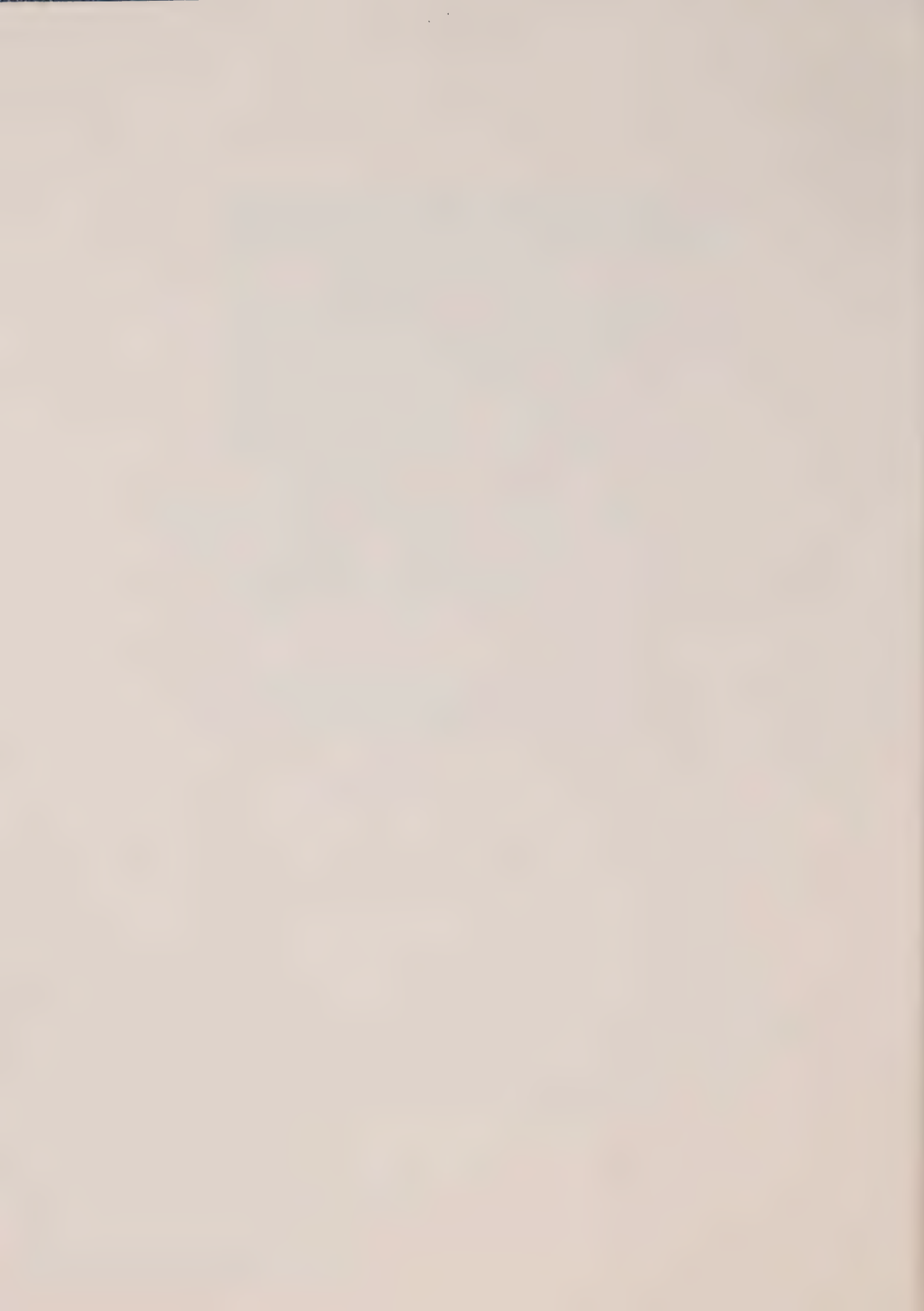
- (e) to rent such space for offices and hearing rooms as he deems necessary or advisable at such rental rates as may be approved by the Treasury Board; and
2. to authorize the Minister of Indian Affairs and Northern Development to designate an officer of the Department of Indian Affairs and Northern Development to act as Secretary for the inquiry and to provide Mr. Justice Berger with such accountants, engineers, technical advisers, or other experts, clerks, reporters and assistants from the Public Service as may be requested by Mr. Justice Berger.

HIS EXCELLENCY THE GOVERNOR GENERAL IN COUNCIL is further pleased hereby to direct Mr. Justice Berger to report to the Minister of Indian Affairs and Northern Development with all reasonable despatch and file with the Minister the papers and records of the inquiry as soon as may be reasonable after the conclusion thereof.

HIS EXCELLENCY THE GOVERNOR GENERAL IN COUNCIL, with the concurrence of the Minister of Justice, is further pleased hereby, pursuant to section 37 of the Judges Act, to authorize Mr. Justice Berger to act on the inquiry.

CERTIFIED TO BE A TRUE COPY - COPIE CERTIFIÉE CONFORME





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PRELIMINARY RULINGS (I)

by the Honourable Mr. Justice T. R. Berger

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PRELIMINARY RULINGS

by the Honourable Mr. Justice T. R. Berger

I was appointed by the Government of Canada by Order-in-Council dated March 21st, 1974, to conduct an inquiry into the social, environmental and economic impact of the proposed Mackenzie Valley natural gas pipeline.

Canadian Arctic Gas Pipeline Limited has applied to the Minister of Indian Affairs and Northern Development under Section 19(f) of the Territorial Lands Act, R.S.C. 1970, c.T-6, for a right of way across Crown lands in the Yukon and the North West Territories. They propose to build a pipeline up the Mackenzie Valley to bring natural gas from Prudhoe Bay in Alaska and from the Mackenzie Delta to markets in Canada and the United States. The Inquiry I am to carry out is authorized by Parliament under Section 19(h) of the Territorial Lands Act. I am to consider the social, environmental and economic impact regionally of the construction, operation and subsequent abandonment of the proposed pipeline in the Yukon and the North West Territories, and I am to consider as well the measures which Arctic Gas proposes to take to meet the specific social and environmental requirements of the Expanded Guidelines for Northern Pipelines tabled in the House of Commons on June 28th, 1972, and I am to report upon the terms and conditions that ought to be imposed in respect of any right of way that might be granted to Arctic Gas. It will be for the Government of Canada, on the recommendation of the Minister of Indian Affairs and Northern Development to decide whether to grant a right of way to Arctic Gas. It will be for the National Energy Board to determine whether or not to recommend the granting of a Certificate of Public Convenience and Necessity, and for the Government to decide, if such a recommendation is made by the National Energy Board, whether a Certificate should be granted.

Because this Inquiry is unique in Canadian experience, and because of my anxiety that the people of the North and all other Canadians with an interest in the work of the Inquiry should have every opportunity to be heard, and that the Inquiry itself should be thorough and complete, I held preliminary hearings in April and May in Yellowknife, Inuvik, Whitehorse and Ottawa, to hear submissions on the way the Inquiry ought to be conducted. I have decided to outline my views now on the procedure that we will follow in the Inquiry, and to indicate my views on the questions that were raised relating to the scope of the Inquiry.

I.

THE TIMETABLE FOR THE INQUIRY

A. THE EL PASO PROPOSAL

Arctic Gas argued that this Inquiry should be expedited because the El Paso Natural Gas Company intends to apply to the Federal Power Commission in the United States for permission to construct a pipeline to bring natural gas from Prudhoe Bay across Alaska to Valdez, to be liquefied there and then tankered to California. El Paso has already intervened before the Federal Power Commission, where Arctic Gas's sister company, Alaska Arctic Gas Pipeline Limited, has applied for permission to build a natural gas pipeline from Prudhoe Bay to the Yukon border. El Paso intends to oppose Alaska Arctic Gas's application in those proceedings (El Paso has not so far sought to intervene in this Inquiry). It was said that if El Paso's proposal were to be approved by the U.S. authorities, then the economic viability of Arctic Gas's proposal to build a gas pipeline up the Mackenzie Valley intended to bring gas from Prudhoe Bay and the Mackenzie Delta to the U.S. and Canadian markets, would be jeopardized. So, it was urged, it is essential that this Inquiry be expedited.

My mandate is to conduct a fair and a thorough Inquiry. That must come first. I intend to give all those persons and organizations with an interest in the proposal made by Arctic Gas a fair opportunity to be heard. I will not diminish anyone's right to be heard, nor will I curtail this Inquiry so as to improve Arctic Gas's position in relation to the El Paso proposals in the United States.

But there will not be any undue delay. At the Preliminary Hearings all interested parties offered their cooperation to the Inquiry, and indicated their desire to work with the Inquiry. I intend to hold them to that.

B. THE NATIONAL ENERGY BOARD

Some of the native organizations and some of the environmental organizations argued that this Inquiry should not proceed until the National Energy Board has completed its hearings. This is urged upon the ground that if the National Energy Board were to refuse to grant a Certificate of Public Convenience and Necessity, this Inquiry would be unnecessary.

But if it can be said that this Inquiry should wait upon the outcome of the National Energy Board Hearings, it could equally be said that the National Energy Board should wait upon the outcome of this Inquiry, since the terms and conditions that are laid down by the Minister as the result of this Inquiry may alter the basis upon which Arctic Gas seeks a Certificate of Public Convenience and Necessity. How can the National Energy Board decide whether to grant a Certificate of Public Convenience and Necessity, and how can Arctic Gas be expected to proceed with its request for such, without knowing the terms and conditions under which Arctic Gas is entitled to the right-of-way (assuming the Minister decides to grant a right-of-way at all) which it must obtain if it is to go ahead with the pipeline? A recitation of these arguments reveals that the relationship between this Inquiry and the National Energy Board cannot be comprehensively defined at this stage. I do not think it has been shown that this Inquiry ought to wait until the National Energy Board has completed its hearings and made a recommendation to the Government, and the Government has acted upon it one way or the other, before getting under way.

In any event this Inquiry is not just about a gas pipeline; it relates to the whole future of the North. I am bound to examine the social, economic and environmental impact of the construction of a gas pipeline in the North. But the Pipeline Guidelines do not stop there. They require that the impact of the pipeline should be considered in the context of the development of a Mackenzie Valley transportation corridor.

The influence of a gas pipeline in the development of a Mackenzie Valley transportation corridor and in moulding the social, economic and environmental future of the North will be enormous. The Pipeline Guidelines contemplate the development of a corridor up the Mackenzie Valley to enable the bringing of oil and gas to southern markets. This Inquiry has been established to ensure that the gas pipeline proposal is not considered in isolation. The Mackenzie River has been a transportation system for centuries, first for the native people, then for the white people. The Mackenzie Highway is

already under construction, and already reaches beyond the junction of the Liard and the Mackenzie at Fort Simpson. The Pipeline Guidelines envisage that, if a gas pipeline is built, an oil pipeline may follow, and that the corridor may eventually include a railroad, hydro-electric transmission lines, and telecommunications facilities. It would be a mistake to dismember the corridor envisaged by the Pipeline Guidelines, and to consider the gas pipeline in isolation.

It is for that reason that I think this Inquiry should not wait upon the outcome of the proceedings before the National Energy Board. This Inquiry, covering the social, environmental and economic impact of the pipeline proposal against the background of the corridor concept, ought to proceed. The Order-in-Council does not impose any restriction upon the commencement of this Inquiry, and I do not think I should impose one.

II. HEARINGS

I intend to visit the communities in the Mackenzie Valley, the Delta and the Yukon, likely to be affected by the construction of the pipeline. I intend to do this before the hearings begin. I intend to travel by myself. My visit will be designed to enable me to get to know the people and the way they live, and not to obtain evidence about the impact of the pipeline or their views on the pipeline; that will come later, at the hearings.

A. FORMAL HEARINGS

I think the formal hearings should begin with an overview of the Mackenzie Valley, the Delta, and the area across the northern Yukon where the pipeline is to go. Commission Counsel will bring forward this evidence through witnesses called by him for the purpose. The overview evidence would include such matters as the history, culture and economy of the Northern peoples, the geography and geological history of the Mackenzie Valley, the Delta and the Yukon; the climate; the geotechnical aspects of northern construction; terrain types, including permafrost; and resources, renewable and non-renewable.

After that the Inquiry will hear the evidence of Arctic Gas. Arctic Gas suggested at the preliminary hearings that it would simply offer formal proof of the material filed in support of its right-of-way application, and then offer its witnesses for cross-examination. That will not be good

enough. I expect Arctic Gas to call as witnesses the people who prepared the material and who carried out the field work on which it is based. I expect Arctic Gas's witnesses to be examined in chief in the usual way, to delineate, explain and discuss the material filed, before cross-examination. I should also say that I expect Commission Counsel to examine in chief each of the members of the Assessment Group assembled by the Government of Canada with a view to a complete canvass of all relevant evidence that each of them has to give. The members of the Assessment Group, like the witnesses for Arctic Gas, will be subject to cross-examination. The same procedure will apply to witnesses called by any of the parties at the formal hearings.

B. COMMUNITY HEARINGS

I intend to hold hearings in each of the communities in the Mackenzie Valley, the Delta and the Yukon that are likely to be affected by the pipeline, to allow the people living in those communities to tell me their views about the proposed pipeline.

The native organizations have said that the formal hearings, at which evidence is to be called relating to the social, environmental and economic impact of the proposed line, should not take place until the community hearings have been completed. I think it would be a mistake to try to impose a rigid framework like that on the scheduling of the community hearings. The purpose of the hearings in the communities is to offer the people living there an opportunity to state in their own languages and in their own way their views about the gas pipeline and the development that it will inevitably bring in its wake.

If the community hearings are going to offer the native people the opportunity they deserve to consider the proposal made by Arctic Gas, the report of the Assessment Group, and the other evidence to be given at the formal hearings, and then to state their case, they ought not to be held before the formal hearings. Instead I think the community hearings ought to be held concurrently with the formal hearings. By that I mean that the Inquiry should break off the formal hearings from time to time to hold hearings in the communities, to ensure that the native people in the communities have an opportunity to answer whatever may be said by the witnesses called at the formal hearings about the social, environmental and economic issues relating to their communities. It seems to me that the people living in the communities will not have the means

of knowing the full extent of the material gathered by Arctic Gas, or the means to study it, or to know its specific application to each community, unless the community hearings proceed concurrently with the formal hearings.

At the community hearings I also want to give the native people an opportunity to tell the Inquiry about the impact seismic lines and other kinds of industrial activity have had on the land, on wildlife and the environment, and their own opinions of the likely effect of the construction of the pipeline on the land, the wildlife and the environment. I am anxious that the native people should bring their whole experience before the Inquiry. I do not think they will get that chance if we hold the community hearings first and then go on to the formal hearings.

At the same time I want to make it plain that I do not intend to hold any community hearings until the people living in the communities have had the opportunity of informing and preparing themselves for them. I want to say also that I expect that native persons will be called as witnesses from time to time at the formal hearings. The native people should not be confined to the community hearings for the purpose of presenting their case.

It is my conviction that the formal hearings and the community hearings should be regarded as equally important parts of the same process, and not as two separate processes.

III. PRACTICE AND PROCEDURE

I do not intend to lay down a comprehensive set of formal rules of practice and procedure. But I do want to deal with some of the issues that arose at the preliminary hearings.

A. INTERVENORS

All of the persons and organizations that made submissions at the preliminary hearings will have the right to intervene and to participate in the Inquiry. They will be notified when hearings are scheduled, and will be given an opportunity to present their submissions at the time and place most convenient to them.

As regards any other persons or organizations wishing to intervene in order to participate on a continuing basis in the hearings or merely to make a submission, advertisements will be placed in the newspapers throughout Canada, and announcements made over radio and television in the North, to notify any persons or organizations wishing to make submissions of the dates and places when they may do so, and prescribing the times within which their submissions, if in writing, should be sent to the Inquiry.

I expect that Arctic Gas, the native organizations, and the environmental organizations will participate in the formal hearings and the community hearings on a continuing basis. But that does not limit the right of any other intervenor to participate on a continuing basis. Every effort will be made by Commission Counsel to work out a timetable for the hearings in consultation with and with the cooperation of the intervenors.

B. REQUESTS BY THE ASSESSMENT GROUP FOR SUPPLEMENTARY INFORMATION AND MATERIAL

The Assessment Group will prepare, for the purposes of the Inquiry, requests to Arctic Gas for supplementary information and material relating to matters which the Pipeline Guidelines require Arctic Gas to include in its application for a right-of-way and which, in the view of the Assessment Group, have not been dealt with at all in the application, and information and material relating to matters where the Assessment Group is of the view that the application, though it deals with matters required by the Guidelines, does not in all respects come to grips with the requirements laid down by the Guidelines.

These requests will come to the Inquiry. Arctic Gas and the intervenors will be advised by the Inquiry of any request made by the Assessment Group for supplementary information and material, and the same procedure will be followed as regards the answers made by Arctic Gas to such requests. The requests and the answers will be made available to the public.

C. THE ASSESSMENT GROUP'S REPORT

The report or reports of the Assessment Group containing the Group's analysis of the material filed by Arctic Gas in support of its Application, will be filed with the Inquiry and copies will be made available to the intervenors and the public.

D. DISCOVERY

Commission Counsel will, in consultation with counsel for the intervenors, develop procedures for discovery of all studies and reports in the possession of the government of Canada as well as Arctic Gas and the intervenors. Such material must of course be relevant to the Inquiry.

As I have said, I expect that at the hearings Arctic Gas, the native organizations and the environmental organizations will be represented throughout. All of them should be prepared to call witnesses early on to discuss in a general way the studies they have carried out and the reports they have prepared, on matters relating to the Inquiry. Commission Counsel will call appropriate witnesses from the public service for the same purpose. On cross-examination it should be possible to obtain complete discovery. Of course any objections to the production of any studies or reports will be considered by the Inquiry.

E. SUBPOENAS

As the Inquiry proceeds, should it be necessary, I will exercise my power of subpoena. For the time being I do not intend to lay down any strict rules governing the exercise of that power.

IV. SCOPE OF THE INQUIRY

A number of arguments arose at the preliminary hearings regarding the scope of my terms of reference.

Let me say at once that the scope of this Inquiry is defined by the Order-in-Council and by the Pipeline Guidelines. Both the Order-in-Council and the Pipeline Guidelines are cast in broadly worded language. They say I am to conduct a social, economic and environmental impact study. It is a study whose magnitude is without precedent in the history of our country. I take no narrow view of my terms of reference.

I am going to indicate my views on the questions raised at the preliminary hearings regarding the scope of the Inquiry. But I am not in any way seeking here to delineate the whole configuration of the Inquiry; rather I am simply trying to settle some of the questions that were clearly present in many minds regarding the scope of the Inquiry.

A. NATIVE CLAIMS

The principal submission of the Native organizations is that no pipeline development should proceed until the land claims of the Native peoples have been settled. All of the Native organizations that appeared at the preliminary hearings took the position that one of the terms and conditions that this Inquiry ought to recommend to the Minister of Indian Affairs and Northern Development is that there should be no right of way granted to Arctic Gas until the Native land claims in the Yukon and the North West Territories have been settled.

It was suggested by Arctic Gas that the native people ought not to be allowed to advance such an argument in this Inquiry, on the ground it would not fall within my terms of reference to recommend the imposition of such a term or condition. The Order-in-Council says that I am "to inquire into and report upon the terms and conditions that should be imposed in respect of any right of way that might be granted across Crown lands for the purposes of the proposed Mackenzie Valley pipeline..." It is said that this Inquiry is limited by these words to the consideration of terms and conditions to be performed or carried out by Arctic Gas.

It is true that the Pipeline Guidelines contemplate that the terms and conditions that the Minister decides to impose upon the granting of a right-of-way shall be included in a signed agreement to be made between the Crown and Arctic Gas. But the Order-in-Council doesn't confine this Inquiry to a review of the Pipeline Guidelines and of the measures which Arctic Gas is prepared to take in order to meet them. The Order-in-Council requires that the Inquiry consider the social, economic and environmental impact of the construction of a pipeline in the North. That takes the Inquiry beyond the Pipeline Guidelines, and requires a consideration of what the native organizations say ought to be a condition precedent, to be imposed by the Government, as a matter of policy, quite apart from whatever provisions the Government may require of Arctic Gas or any other company wishing to build a pipeline in a signed agreement for a right-of-way.

I am not saying whether the natives' position is well-founded or not. But it is one which they are entitled to urge upon this Inquiry. In fact, it seems to me that it provides an essential focus for the natives' case regarding the impact of the pipeline on their communities and their way of life. Indeed, I would go further. The case Arctic Gas intends to make is that the pipeline can be built

without prejudice to the settlement of native land claims. The position taken by the natives offers a focus for the consideration of those terms and conditions - not only those which emerge from the Pipeline Guidelines, but also any others which Arctic Gas is ready to propose - which may enable the pipeline to be built without prejudice to native claims.

Notwithstanding the language of the Introduction to the Social Guidelines (in the Pipeline Guidelines) which appears to make some distinction between the Indian people and the Inuit and the Metis for purposes of settlement of their claims, I take the view that so far as this Inquiry is concerned there should be no distinction between the position of the Native peoples. All of them are entitled to urge at this Inquiry that there should be no right of way granted until their claims have been settled.

B. THE CORRIDOR CONCEPT

It has been argued by the Canadian Arctic Resources Committee that my terms of reference include any gas pipeline proposed by any applicant, and that this Inquiry should not be limited to the proposal that has been made by Arctic Gas. Arctic Gas, on the other hand, has argued that this Inquiry should be limited to an examination of the particular proposal to build a natural gas pipeline that Arctic Gas has made in its application to the Minister for a right of way under the Territorial Lands Act.

I do not think that this really gets me very far in ascertaining the limits of the scope of my terms of reference, because the Pipeline Guidelines clearly require an examination of Arctic Gas's proposed pipeline and the route it is to follow in the light of the corridor concept described in the Guidelines. The Pipeline Guidelines relate to the development of a Mackenzie Valley transportation corridor, and not simply to the construction of a gas pipeline.

In any event, the Pipeline Guidelines specifically require a comparison of the proposed pipeline route with alternative pipeline routes. In view of this I do not think there is really any difference between an Inquiry into the impact of the pipeline proposed by Arctic Gas and an examination generally of the impact of the construction of a gas pipeline up the Mackenzie Valley. The purpose of the corridor, according to the Pipeline Guidelines, is to minimize social and environmental disturbance. It is in that connection that a comparison of the proposed pipeline route with alternate pipeline routes is relevant to this Inquiry.

I am also bound to consider the economic and social impact of the construction of an oil pipeline and to consider the combined effect of the construction of a gas pipeline and an oil pipeline in the corridor.

However, I am not prepared to consider the merits of alternate modes of transportation of the gas, except to the extent that an examination of the advantages and disadvantages of other forms of transportation will be of assistance in determining what terms and conditions ought to be imposed if a right of way is granted. For example, a comparison of the extent of environmental degradation that may accompany other modes of transporting the gas may be useful for the purpose of establishing what environmental standards ought to be laid down for the construction of a natural gas pipeline; or a comparison of the opportunities for Northern employment that other modes of transportation may offer may be useful for the purpose of determining what terms and conditions ought to be imposed on Arctic Gas or any other pipeline company, in order to generate Northern employment, if that is desirable. But such evidence must be relevant to the purposes of the Inquiry.

C. SUPPLIES AND EQUIPMENT

The purchase of and transportation of supplies and equipment and material for the proposed gas pipeline clearly falls within the terms of reference of this Inquiry.

D. GATHERING LINES AND GAS FIELDS

Even though Arctic Gas has applied only for a right-of-way for the purpose of constructing a trunk pipeline, I regard it as essential to this Inquiry that I should consider evidence regarding the gas fields in the Delta and the gathering lines to be built in the Delta.

I realize that Arctic Gas will be a common carrier, and not a producer, and that the gathering lines will be built by the producers, and not by Arctic Gas. But these lines are so obviously a part of the pipeline system that any consideration of the impact of the trunk line entails a consideration of the impact of the gathering lines.

But I am not saying that Arctic Gas must bear the burden of adducing this evidence. And I do not know whether the producers will intervene. So it will be the responsibility of Commission Counsel to obtain evidence, pursuant to subpoena if necessary, to enable this Inquiry to consider the location and extent of the gas fields in the Delta, the likely extent of further gas exploration in the Delta, and

the Beaufort Sea, the likely location, design and construction of the gathering lines, and the processing plants that will be needed to render the gas acceptable to the trunk pipeline, and the social, environmental and economic impact that the development of the gas fields and the construction of these lines will have in the Delta and elsewhere in the North.

E. PRODUCER REVENUES AND TAXATION

It was urged by Canadian Arctic Resources Committee that I should consider the revenue to the producers that would be generated by the construction of the proposed gas pipeline.

It was said that I should allow evidence to establish the propriety of imposing a term or condition on the construction of the gas pipeline that would require a part of the revenue from the production of gas in the Delta to be dedicated to the improvement of social services in the North. This is the same thing as saying that I ought to conduct an investigation into the income and profits likely to accrue to the producers by the development of the gas fields in the Mackenzie Delta and then make a determination regarding what would be a fair return to the public from the exploitation of the resource.

That lies beyond my terms of reference. The level of royalties and taxes to be imposed upon the gas producers in the Mackenzie Delta is a matter to be decided by Parliament. That is the place to go with arguments about the adequacy of the return to the Crown from the extraction of the gas.

F. ECONOMIC IMPACT

I do not intend to conduct an examination of the impact of a gas pipeline on the economy of Canada. I am, however, prepared to consider evidence which reveals the particular impact of a gas pipeline on the economy of the North.

It is impossible wholly to disentangle economic consequences from social and environmental consequences. For example, evidence regarding the quantity and quality of the gas in the Delta and the state of natural gas markets, will be of importance for the purpose of determining the life of the pipeline, and such things as the extent to which looping will occur and the number of compressor stations that will be

needed. These relate to economic impact of the pipeline, but they relate as well to the social and environmental impact of the pipeline on the North.

But there will be evidence which relates essentially to economic impact. It must, however, be evidence designed to reveal the economic impact on the North. I am prepared to hear evidence of the effect of the gas pipeline on the rate of inflation, capital markets, the foreign exchange rate and other national economic indicators, to enable this Inquiry to ascertain the effect of the gas pipeline on the economy of the North. But such evidence will be allowed only for that purpose.

It was urged that it is impossible to segregate the impact upon the national economy from the impact upon the economy of the North. But the Order-in-Council provides that I am to have regard to the economic impact regionally of the gas pipeline proposal. I think that fixes the limits of the Inquiry. Whatever impact the construction of a gas pipeline may have on Canada's economy, I do not think that the Order-in-Council allows me to explore it. My mandate is to consider the regional economic impact of the pipeline proposals. That means that I am to consider the economic impact especial to the North, and not the economic impact on the nation as a whole.

G. GREAT BEAR HYDRO PROJECT

The Canadian Arctic Resources Committee said that a study had been made by the Northern Canada Power Commission regarding the feasibility of building three dams on the Great Bear River for the purpose of providing hydro-electric power for the pumping stations on the pipeline. According to the evidence, these proposals proceeded on the basis that such hydro power would be produced more cheaply than the natural gas, and that the hydro power could therefore be used to pump the gas, with a consequent saving of natural gas in the operation of the pipeline. Given a customer whose energy requirements would be of such a magnitude, it would be feasible to proceed with the project, and to generate hydro electric power for Arctic Gas and customers throughout the North.

Such proposals, as outlined to me, were sketchy and incomplete. However, if such a development were to occur, the impact it would have on Fort Franklin, not to mention the whole of the Mackenzie Valley, is obvious. It would constitute in my view an "associated and ancillary facility" within the meaning of the Pipeline Guidelines, and

would clearly fall within this Inquiry. In any event, if it were built for the purpose of providing hydro-electric power to Arctic Gas, it would be necessary to consider its social, environmental and economic impact. It is obvious that it might be urged upon the Inquiry that a term or condition of the right-of-way would be that electricity generated by the project should be used to pump the gas, in order to conserve gas in the operation of the line, and to make possible the electrification of the Mackenzie Valley.

Should evidence come before me which indicates that such a project will be seriously considered if a right of way is granted and a Certificate of Public Convenience and Necessity follows, then I will hear evidence regarding the social, economic and environmental impact of the project.

These will be the limits of the Inquiry in the disputed areas. In concluding what they ought to be I have been guided by the conviction that this Inquiry must be fair and it must be complete. We have got to do it right. The pipeline, if it is built, will have a great impact on the future of Northern development and the shape of Northern communities, and the way of life for Northern peoples. Not simply because a pipeline is to be built, but because of all that it will bring in its wake. To limit the Inquiry to an examination of Arctic Gas's proposal merely, without considering the background against which that proposal is made, without considering the corridor concept indicated by the Pipeline Guidelines, would be to nullify the basis on which this Inquiry was established.

Thomas R. Berger

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PRELIMINARY RULINGS (II)

by the Honourable Mr. Justice T. R. Berger

PRACTICE AND PROCEDURE

Yellowknife, N.W.T.
Ottawa, Ontario.

October 29, 1974.

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PRELIMINARY RULINGS (II)

by the Honourable Mr. Justice T. R. Berger

PRACTICE AND PROCEDURE

Mr. Scott, Commission Counsel, has presented certain proposals regarding practice and procedure. I held further preliminary hearings at Yellowknife on September 12th and 13th, 1974 to consider representations regarding these proposals by counsel for Arctic Gas, counsel for the other participants who appeared, as well as by Commission Counsel. I also considered the submissions made in writing by other participants.

I said in my Preliminary Rulings of July 12th, 1974, that I wanted this Inquiry to be fair and complete. I have had that consideration uppermost in mind in deciding upon these issues of practice and procedure. The Rulings I am handing down today are intended to bring about full disclosure of all the evidence, and to give to all concerned the fullest opportunity to present their case.

As soon as the Inquiry has received the report of the Assessment Group assembled by the Government of Canada to analyze the material filed by Arctic Gas in support of its application for a right-of-way, I will set a date for the commencement of the Formal Hearings of the Inquiry.

I. APPLICATION OF THE RULES:

A. Definition of Participant

Any person shall be deemed a participant if he appears at any Formal Hearing of the Inquiry (including Preliminary Hearings) and gives his name and address to the Inquiry, or if he advises the Inquiry in writing of his intention to appear. Special Counsel shall maintain a list of participants which shall be available for inspection by any person at the offices of the Inquiry in Yellowknife and in Ottawa.

B. These rules shall apply only to the following participants in the Inquiry:

Canadian Arctic Gas Pipeline Limited

Foothills Pipe Lines Ltd.

Canadian Arctic Resources Committee*

Environment Protection Board

Indian Brotherhood of the North West Territories

Metis Association of the North West Territories

Inuit Tapirisat of Canada

Committee for Original Peoples' Entitlement

Yukon Native Brotherhood

North West Territories Association of Municipalities

Commission Counsel

*Mr. Anthony and Mr. Lucas, counsel for Canadian Arctic Resources Committee, have advised the Inquiry that the Northern Assessment Group, established by Canadian Arctic Resources Committee, the Canadian Nature Federation, the Federation of Ontario Naturalists, Pollution Probe, and the Canadian Environmental Law Association, for purposes of this Inquiry, will comply with any Rules of this Inquiry applicable to Canadian Arctic Resources Committee.

C. These Rules will not apply to any other participants at the Formal Hearings.

D. These Rules will not apply to the Community Hearings.

II.

OVERVIEW HEARINGS

Witnesses called at the Overview Hearings will not be cross-examined during the Overview Hearings, unless it is essential to a fair hearing. In any event, all overview witnesses will be subject to recall for further examination and for cross-examination at the Formal Hearings.

III.

FORMAL HEARINGS

A.

Division of Formal Hearings:

The Formal Hearings will be divided into four phases.

Phase 1.Engineering and Construction of the Proposed Pipeline

This phase of the hearings will include such matters as the size of the pipeline, its location, the timing of construction, the composition and deployment of construction crews, the construction of compressor stations, etc.

Phase 2.The Impact of a Pipeline and Mackenzie Corridor Development on the Physical Environment:

This phase of the hearings will include the impact on the land, the air and the water, and will cover such things as the effect on permafrost, river crossings, slope stability, gravel and other borrow locations, etc.

Phase 3.The Impact of a Pipeline and Mackenzie Corridor Development on the Living Environment:

This phase of the hearings will include the impact on plant and animal life, including wildlife, mammals and fishes.

Phase 4.The Impact of a Pipeline and Mackenzie Corridor Development on the Human Environment:

This phase of the hearings will include social and economic impact.

This division is for purposes of convenience only. The four phases will not necessarily encompass all of the evidence that will be brought forward at the Formal Hearings.

Commission Counsel will therefore invite the participants to consult with him from time to time with a view to determining whether there should be any further division of the hearings within each phase. In any event, it will be open to any participant to call evidence out of order when that is appropriate.

Special Counsel will provide to each participant Notice of Hearing with respect to each of the four phases of the Formal Hearings and will advise the public generally of the matters to be considered at each phase of the Formal Hearings.

B. Calling Evidence and Examination of Witnesses

At the Formal Hearings, as a general rule, Arctic Gas will lead its evidence first, followed by the other participants and Commission Counsel. Arctic Gas will be entitled to call evidence in rebuttal. From time to time other participants will lead off; when they do they will have the right to call evidence in rebuttal after the evidence for the other participants has been heard; in any event the rights of all concerned to bring forward all their evidence on every issue will be preserved.

With respect to witnesses, counsel for any participant calling a witness will examine him in chief, the witness will then be cross-examined by Counsel for each of the other participants and by Commission Counsel. Counsel for the participant calling the witness will be entitled to re-examine.

Commission Counsel will have the responsibility of calling the evidence of the members of the Assessment Group assembled by the Government of Canada, with a view to a complete canvass of all relevant evidence that the Group has to give. The Group will be subject to cross-examination.

Commission Counsel will also be responsible for calling the evidence of members of the public service of Canada not included in the Assessment Group, whose evidence is regarded as necessary to the completeness of the Inquiry.

It will also be the responsibility of Commission Counsel to obtain evidence, pursuant to subpoena if necessary, to enable the Inquiry to consider the location and extent of the gas fields in the Mackenzie Delta, and the likely extent of further oil and gas exploration in the Delta, and the Beaufort Sea, the likely location, design and construction of the gathering lines there, and the processing plants that will be needed to render the gas acceptable to the trunk pipeline, and the social, environmental and economic impact that the development

of the gas fields and the construction of these lines will have in the Delta and elsewhere in the North.

All of the witnesses giving this evidence will be subject to cross-examination, and Commission Counsel will be entitled to re-examine each of them.

Evidence can be introduced through individual witnesses or panels of witnesses.

C. Place of Formal Hearings

Yellowknife will be the main centre for the Formal Hearings. At the same time I am anxious that as much as possible of the evidence relating to oil and gas activity in the Mackenzie Delta and the Beaufort Sea and relating to the impact of such activity should be heard at Inuvik.

It may be appropriate for some of the evidence at the Formal Hearings to be heard in Ottawa. In any event, it will be necessary in due course to hold hearings in major southern centres to enable Canadians who cannot appear in the North to express their views.

IV. COMMUNITY HEARINGS

Community Hearings will be held in each community in the Mackenzie Valley, the Mackenzie Delta and the Yukon likely to be affected by the construction of a pipeline and by corridor development. I have appointed Professor Michael Jackson of the Inquiry staff to act as Co-ordinator of the Community Hearings. He has established a committee which consists of counsel representing the participants chiefly concerned with the organizing of the Community Hearings.

With regard to those communities which have primarily a native population, I expect that the native organizations will bring proposals to Professor Jackson's committee as to the way in which the hearings in those communities ought to be conducted. These proposals should be considered by the committee, and the committee's recommendations referred to me.

In the same way, with regard to those communities which have primarily a white population, I expect that the North West Territories Association of Municipalities will come forward with proposals regarding the conduct of those hearings and that they will be considered by Professor Jackson's committee and the recommendations of the committee referred to me.

If the Committee does not reach agreement on any matter, I will consider the recommendations of each of its members. In any event, I will be prepared to consider the views of any participant regarding the conduct of the Community Hearings.

The Inquiry is arranging with the Canadian Broadcasting Corporation for summaries of the evidence given at the Formal Hearings to be broadcast to Northern communities likely to be affected by the construction of a pipeline and the development of a Mackenzie Valley Transportation Corridor. The broadcasts will be on a regular basis, and will consist of summaries of the evidence given at the Formal Hearings. I expect that these broadcasts will be in English and in the native languages, so that the people in the communities will know what has been said at the Formal Hearings and will be able to respond to it when the Inquiry reaches the communities.

I should make it plain that I intend at the Community Hearings to give every one who wishes to express his point of view, whether it is one widely held in the community or not, an opportunity to be heard.

V. EVIDENCE RELATING TO NATIVE CLAIMS

I said, when I handed down my Preliminary Rulings on July 12th, that it would be open to the native peoples in this Inquiry to argue that no right of way should be granted for a pipeline until their land claims were settled.

Native claims are based on traditional use and occupation. Evidence relating to current use and occupation will obviously include such things as the location of trap lines, fishing camps and hunting grounds, berry picking areas and so on. I want to hear from the trappers, hunters and fishermen and others in the native communities not only about their present use of the land, and the extent of their reliance upon it, but also their views on the likely efficacy of any measures proposed by Arctic Gas to build a pipeline without damaging these native interests; by that I mean that I want to hear the evidence they have to give, and the representations they wish to make, regarding likely interference with trap lines, obstruction of streams, spoliation of hunting grounds and so on.

It seems to me that in order to be fair to Arctic Gas, such evidence should be laid before the Inquiry, so that Arctic Gas will be in a position to indicate what terms and conditions they are prepared to submit to, what safeguards they are prepared to adopt, and what measures they are prepared to

take, in support of their contention that a pipeline can be built without impairing the native people's current use and occupation of the land.

Now such evidence would be of the first importance to this Inquiry even if the issue of native land claims had never been raised. That brings me to the problem of how to deal fairly with the contention of the native organizations that no pipeline should be built until their land claims have been settled. Their claims are based on traditional use and occupation and, according to Professor Cumming, senior counsel for the Inuit Tapirisat of Canada and the Committee for Original Peoples' Entitlement, they include not only lands which are subject to current use and occupation, but extend to lands they do not use and occupy today. Mr. Sutton, counsel for the Indian Brotherhood of the North West Territories and the Metis Association of the North West Territories, took the same position. So did Mr. Lueck, counsel for the Yukon Native Brotherhood.

How then can this Inquiry come to grips with a contention that no pipeline should be built until native land claims are settled, when those land claims relate to ancestral lands which the native people no longer use or occupy?

It is not for this Inquiry to decide the legitimate extent of native land claims in the North. But the native organizations have said to this Inquiry that no pipeline should be built until their land claims have been settled. Those who want to build the pipeline are entitled to an opportunity to meet this by showing that the pipeline can be built without prejudice to native land claims.

I think, therefore, that the native organizations should indicate the nature and extent of their land claims. Given that their view is that any settlement ought to acknowledge that the native people have certain rights that they should be entitled to assert in respect of the lands they claim, there should be some indication of the nature of the rights they assert and of their extent. (The land use studies being carried out by the native organizations relate, as I understand it, not only to land which is the subject of current use and occupation, but also land which, though the native people no longer use or occupy it, they used to. These studies should be of real assistance to the Inquiry. Some of these studies are complete. Some are not yet complete. But, even where they are not complete, the work done so far may well be helpful). The Inquiry will then be in a position to indicate to the Minister what measures ought to be taken to ensure that the native peoples, in their negotiations with the Government, do not find themselves at any disadvantage owing to the building of the pipeline, and, looking to the consummation of negotiations, what measures ought to be taken to ensure that whatever the extent of the native interest that may ultimately be recognized

by any settlement, it will not be diminished by the construction of the pipeline in the meantime.

It should, of course, be remembered that it will be for the Government of Canada and the native peoples to negotiate a settlement of the native claims in the North. It is only the Government of Canada and the native peoples of the North that are parties to the negotiations to settle native land claims. Nothing said at this Inquiry can bind either side. Any delineation of native claims before the Inquiry will be for the purpose merely of ensuring that the Inquiry can fairly consider the principal contention of the native organizations regarding the construction of the pipeline and the answer that those who propose to build the pipeline have to make to that contention.

VI. DISCOVERY

A. Discovery of Witnesses

Every participant shall before giving evidence himself or calling witnesses on his behalf file with Special Counsel at least two weeks before giving evidence or calling such evidence, a synopsis of the evidence of the witness intended to be called, together with a list of any reports, studies or other documents to which that witness may refer or upon which he may rely.

This Rule was suggested by Commission Counsel to expedite the hearings. It will sometimes be difficult to comply with. If any participant cannot comply with the Rule that will not necessarily preclude the calling of the witness in question, at the time the witness is presented to the Inquiry, but it may mean the witness will have to be recalled later on for cross-examination.

B. Production of Studies and Reports

All of the participants, except Arctic Gas, expressed their willingness to provide a list of all studies and reports in their possession or power relating to the Inquiry, including those for which privilege might be claimed.

Mr. Goldie, counsel for Arctic Gas, was not prepared to go along with this. Instead, he suggested that, as each of the witnesses for Arctic Gas is called, there should simply be provided a list of all studies and reports which that witness relies upon, or which touch upon his testimony. It was said that this would be sufficient, and that it would be impracticable for Arctic Gas to provide a list of all its studies and reports before the Formal Hearings begin.

In my judgment there is a paramount public interest in the fullest disclosure of all the facts, which requires that a list of all studies and reports in the possession or power of Arctic Gas relating to the Inquiry should be supplied to the Inquiry. It was not suggested that this would be impossible, it was simply urged that it would be difficult for Arctic Gas to comply with such a direction.

It would not be satisfactory for Arctic Gas merely to provide a list of studies and reports to accompany the testimony of each witness. If we were to proceed in that way, we would only get the material in a piecemeal fashion. If we do not require a complete list, there can be no guarantee that there will be full disclosure of all studies and reports prepared by Arctic Gas relating to the Inquiry. It would be open to Arctic Gas to decide for itself which witnesses it ought to call and thus avoid the necessity of disclosing the existence of a study or a report which might be damaging to its case but which would be useful to the Inquiry. That will be avoided if a complete list is supplied.

I therefore direct that all of the participants to whom these Rules apply, including Arctic Gas, must provide a list of all studies and reports in their possession or power relating to this Inquiry. These lists should be filed with the Inquiry by November 30th, 1974, and copies provided to all of the participants to whom these Rules apply. If they are ready earlier they should be filed as soon as they are ready and distributed to the other participants; in fact, each participant may well decide to circulate a list of all studies and reports in its possession relating to Phase I of the Inquiry, without waiting until its list is ready covering all phases of the Inquiry. I appreciate that by November 30th, 1974, some of the participants will not have completed all the studies and reports they intend to prepare. They should file a list nevertheless, and add to it as they go along. Commission Counsel will be responsible for providing a list of all studies and reports of the Government of Canada.

When the lists have been provided, it will be open to the other participants to demand that any study or report on any list should be produced. If any participant wishes to raise a claim of privilege as the basis for an objection to production at that stage, the Inquiry will of course consider it then. It should be remembered that under Section 19(f) of the Territorial Lands Act, R.S.C. 1970, c.T-6, any one appointed to conduct an inquiry has the power:

"for the purposes of the inquiry, to summon and bring before him any person whose attendance he considers necessary to the inquiry, examine such persons under oath, compel the production of documents and do all things necessary to provide a full and proper inquiry."

These powers have been conferred on this Inquiry by the Order-in-Council of March 21st, 1974.

In addition, any participant may in the meantime request of any other participant a copy of any study or report whether or not it appears on the list filed by the participant of whom it is requested, and whether or not such a list has already been filed.

VII. APPLICATIONS TO THE INQUIRY

Any applications made by participants to the Inquiry for subpoenas or any relief whatever shall be made upon reasonable notice to the Inquiry and Commission Counsel as well as any participant directly affected by the application and any other participant that the Inquiry decides should be given notice of the application. If the hearings are in progress the application can be made to the Inquiry at the hearing on the day when it is returnable.

VIII. CHANGES IN THESE RULES

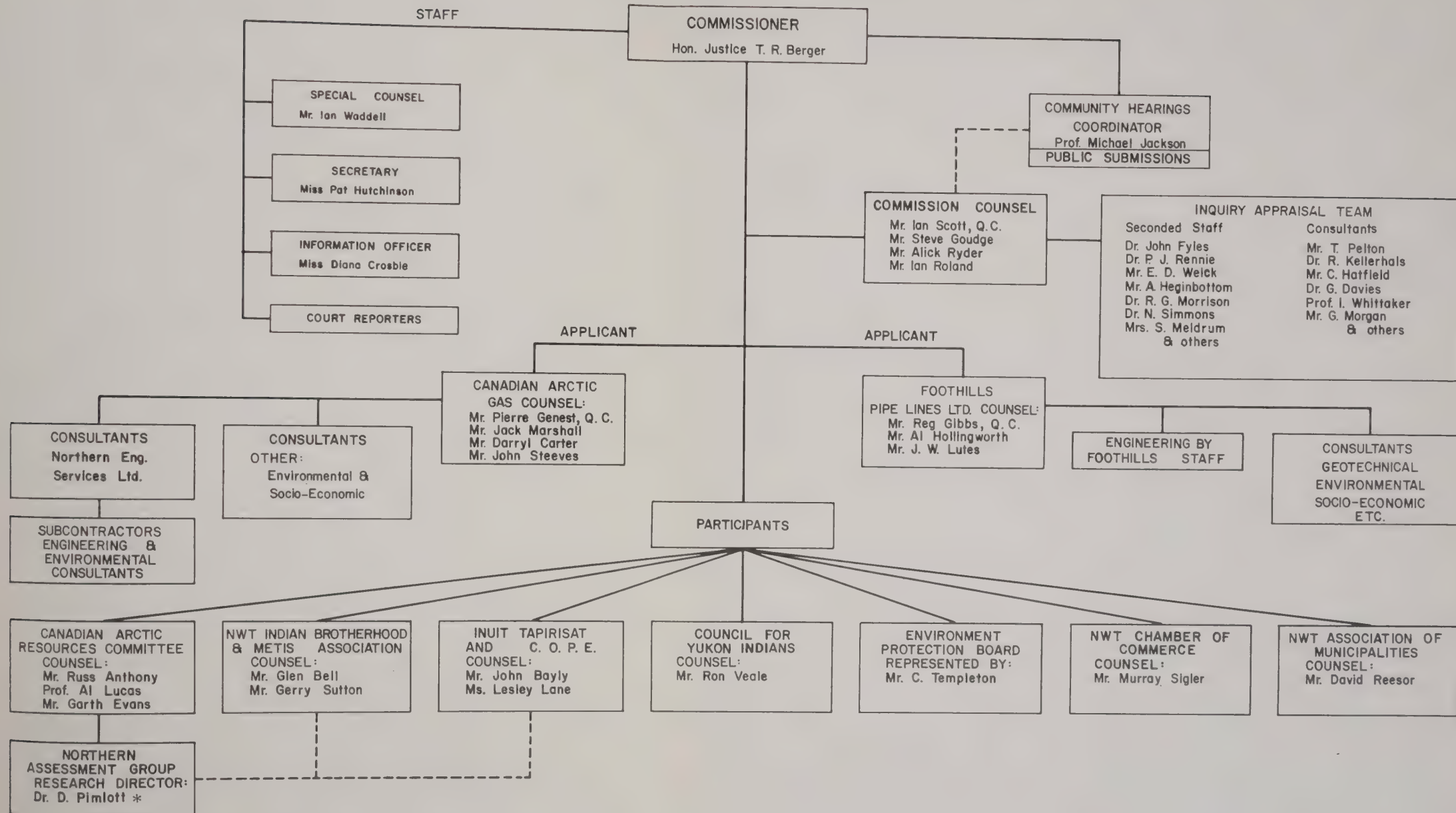
The Inquiry retains the power to add to, alter or modify these Rules, or to require that any participant not already bound by them should comply with them in whole or in part, as well as the power to exempt any participant from complying with them in whole or in part.

IX. INSPECTION BY THE PUBLIC

Copies of the material filed by any participant, or other person or organization, including lists of studies and reports, the transcript of the hearings, and copies of the exhibits, will be on file during office hours, and available for inspection by the public, at the Inquiry offices at Yellowknife and at Ottawa.

John R. Berger

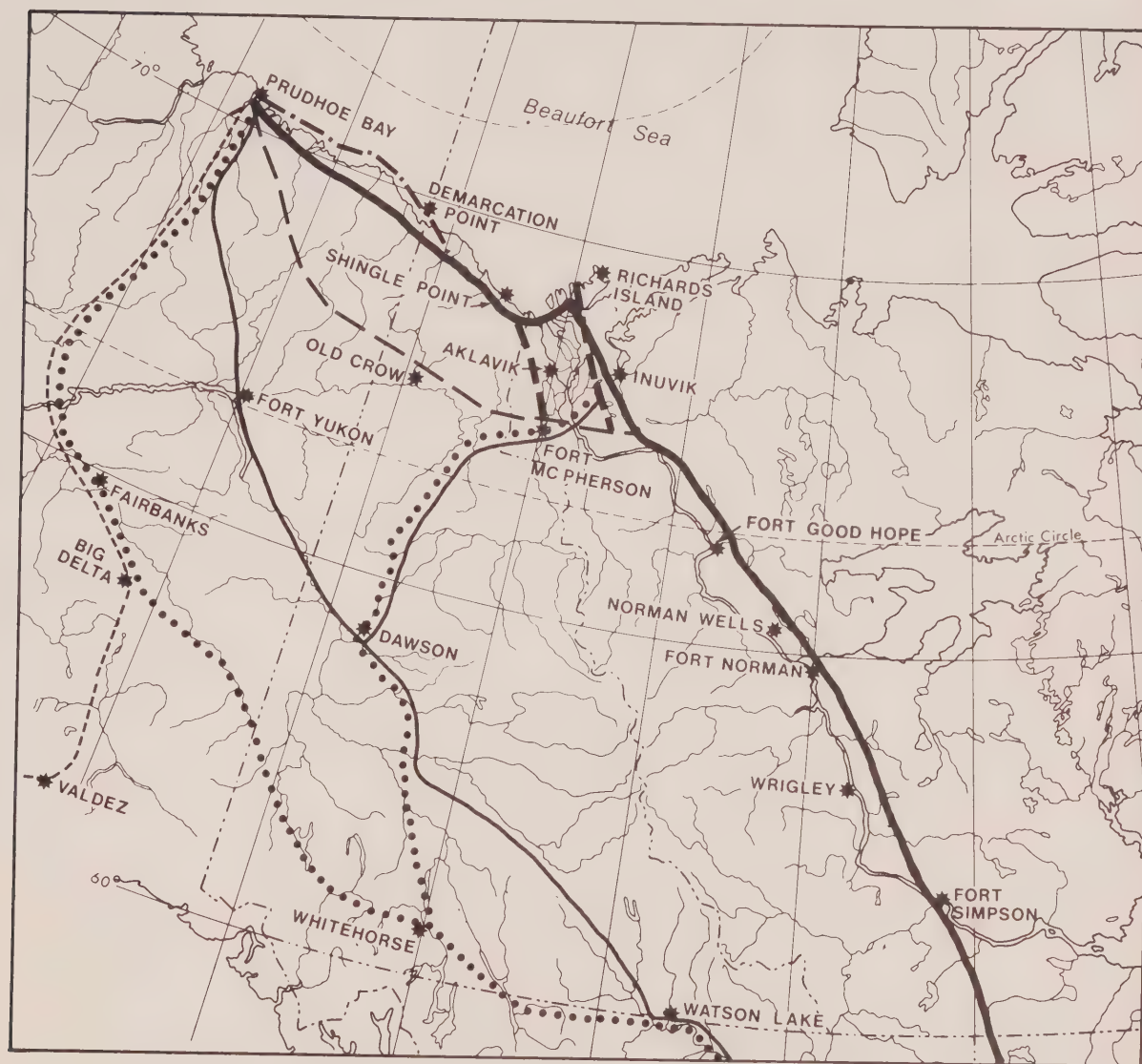
MACKENZIE VALLEY PIPELINE INQUIRY



* Replaced Dr. J. Spence Jan. 1976

ALTERNATIVE ROUTES & CORRIDORS

NORTH OF THE 60TH PARALLEL



LEGEND

- PRIME ROUTE
- PRIME ROUTE ALTERNATIVE
- INTERIOR ROUTE
- OFFSHORE CORRIDOR
- FAIRBANKS CORRIDOR
- FORT YUKON CORRIDOR
- ALYESKA PIPELINE

Scale: 1" = 140 miles

MACKENZIE VALLEY PIPELINE INQUIRYINDEX TO SUMMARIES

<u>Place</u>	<u>Subject</u>	<u>Date</u>	<u>Trans. No.</u>	<u>Summ. No.</u>
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YELLOWKNIFE	Facilities Location and Connecting Pipeline Facilities	Mar. 11-14	15-18	* 2
AKLAVIK	Community hearing	Apr. 2-4	1-3	3
YELLOWKNIFE	Geotechnical Aspects of Engineering Design and Ancillary Facilities	Mar. 17-21 Apr. 7-14	19-29	* 4
YELLOWKNIFE	System Configuration and Design of Facilities	Apr. 14-18	29-33	* 5
YELLOWKNIFE	CAGPL - Construction Plan	Apr. 21-23	33-39	* 6
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YELLOWKNIFE	CAGPL - Operation and Maintenance	May 16-21	40-42	* 7
HAY RIVER	Community Hearing	May 28-29	4-5	8(a)
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* Summaries incorporated in this volume

** Transcripts not available at time of printing

*** Dates subject to revision

February 25, 1976





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Mackenzie Valley Pipeline Inquiry, Summaries of Proceedings

Volume 2
Physical & Living Environments

Yellowknife, N.W.T.
June 2, 1975 – April 7, 1976

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PREFACE

The Mackenzie Valley Pipeline Inquiry was established on March 21, 1974 by Order-in-Council P.C. 1974-641. The Minister of Indian Affairs and Northern Development, Jean Chrétien, at the same time appointed Mr. Justice T.R. Berger of the Supreme Court of British Columbia as Commissioner of the Inquiry charged with the task of inquiring into and reporting upon the terms and conditions that should be imposed in respect to any right-of-way that might be granted across Crown lands in the Yukon and Northwest Territories for a proposed Mackenzie Valley pipeline, having regard to:

1. The social, environmental and economic impact regionally, of the construction, operation and subsequent abandonment of the proposed pipeline in the Yukon and Northwest Territories, and,
2. Any proposals to meet the specific environmental and social concerns set out in the Expanded Guidelines for Northern Pipelines of 1972.

An application for the grant of right-of-way under authority of the Territorial Lands Act for the purpose of constructing a pipeline across Crown lands in the Yukon and Northwest Territories to transport natural gas from Prudhoe Bay and the Mackenzie Delta to southern markets in the United States and Canada was submitted to the Department of Indian Affairs and Northern Development by Canadian Arctic Gas Pipeline Limited on March 21, 1974. On May 1, 1975, Foothills Pipe Lines Limited, in conjunction with Alberta Gas Trunk Line (Canada) Limited, submitted an application for a grant of right-of-way to construct an all-Canadian pipeline up the Mackenzie Valley to transport natural gas from the Mackenzie Delta to southern Canadian markets. These two proposals were referred to Mr. Justice T.R. Berger for examination by his Inquiry at public hearings.

Justice Berger held preliminary hearings to inquire into and determine the nature of the public hearings in Yellowknife, Inuvik, Whitehorse and Ottawa in late April and early May, 1974, and issued preliminary rulings as a result of these hearings. Procedural hearings were then held by the Inquiry in Yellowknife on September 12 and 13, 1974 to receive comments on proposals by Commission Counsel regarding timing and procedural rules for future public hearings. As a consequence it was decided to hold formal hearings in Yellowknife, N.W.T., and in Whitehorse, Y.T., and that the hearings would be defined in subject areas comprising:

- Phase I - Construction and Engineering
- Phase II - Impact on the Physical Environment
- Phase III - Impact on the Living Environment
- Phase IV - Impact on the Human Environment

Community hearings were to be informal, ie., not confined to a particular phase, and witnesses appearing would be sworn but not cross-examined. These hearings would be held in communities throughout the Territories which were most likely to be affected by pipeline development activity. In addition, hearings would be held in major centres in southern Canada.

The Mackenzie Valley Pipeline Inquiry summaries will be published in several volumes of which this is the second. Volume 1 which was published early in 1976 dealt with the engineering and construction aspects of the evidence. Volumes to follow will include the summaries pertaining to the Mackenzie Delta, Socio-Economic factors, Community Hearings and Final Arguments.

The summaries were prepared primarily by Mr. Don Gamble of the Northern Policy and Program Planning Branch of the Department of Indian Affairs and Northern Development with the editorial assistance of Mrs. Nancy Lonnay. They appeared originally in a numbered, chronological series and were widely distributed in that form. Reference is made to this numbered series in Appendix III. The summaries attempt to provide, in abstract, information which is contained in the lengthy transcripts of the Inquiry proceedings. They are an unofficial guide to the transcripts and should not be construed as representing any position or policy of the Department of Indian Affairs and Northern Development.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGSPhysical & Living Environments

Yellowknife, N.W.T.
June 2, 1975 - April 7, 1976

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MACKENZIE VALLEY PIPELINE INQUIRY
SUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES 46 TO 48)

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TOPIC: Environment Protection Board Panel
(evidence in chief)

DATE: June 2, 3 and 4 in Yellowknife

WITNESSES: Panel representing the Environmental Protection Board

- Mr. C.H. Templeton: President, Templeton Engineering and Chairman of the Environmental Protection Board (EPB).
- Dr. L.C. Bliss: Professor of Botany, University of Alberta.
- Dr. I. McTaggart Cowan: Professor of Zoology, University of British Columbia (U.B.C.)
- Mr. D.W. Craik: Consulting Engineer and M.P.P. (Manitoba).
- Dr. N.J. Wilimovsky: Professor of Faculty of Graduate Studies, Institute of Resource Ecology and Curator of Fishes, U.B.C.
- Mr. E. Gourdeau: Consultant (Forestry and Economics and guest lecturer at Laval and Sir George Williams University
- Dr. K. Adam: Associate Professor of Civil Engineering, University of Manitoba.
- Dr. S.S. Thomson and Dr. Britton: University of Alberta (now with the U.S. Geological Survey) Both were not able to appear due to prior commitments.

NOTE: The Environmental Protection Board presented evidence 'in chief' only. They were not subject to any cross-examination. Members of the Board may be called for cross-examination in the future.

HIGHLIGHTS

TRANSCRIPT REFERENCE

(a) Technical/Engineering

- The engineering design considerations which could most substantially contribute to a negative environmental impact were outlined by Dr. Adam. The untried techniques proposed by the applicant for dealing with frost heave and drainage led the Board to recommend that the pipeline not be chilled to below freezing temperatures south of Willowlake River. The main concerns were permafrost degradation - settlement, frost heave, drainage disruption, slope stability and river crossings. Particular emphasis was placed on the proposed insulated culvert technique for handling sub-surface drainage across a frost bulb. Dr. Adam stressed that this technique was new and untried. It was shown that the five frost heave techniques proposed were the same for initial design and subsequent remedial measures. It was

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(a) Technical/Engineering (Cont'd.)

pointed out that if the design technique didn't work, the same technique used as a remedial measure was also bound to fail. Furthermore, of the 5 techniques Dr. Adam indicated that only two - surcharging and restraint, were for general application. Both these relied on the cut-off pressure theory which was questionable in light of Dr. McKay's observations. Not chilling the pipeline to below freezing south of Willowlake River would decrease this type of problem.

(b) Environmentalb-1 Board Concept

- Robert Blair originally approached Templeton Engineering to advise how environment protection measures could be built into a large project to bring gas south from Prudhoe Bay, according to evidence led by Mr. Templeton. Templeton Engineering defined four possible protection methods utilizing: (1) the pipeline company staff, (2) environmental consultants hired by the pipeline company, (3) government and, (4) an independent board. The first two were rejected because their effectiveness has historically been overridden by financial and union considerations. The third method (government) was rejected because of the lack of regulations for such a large project and because of the jurisdictional confusion between and within the various government departments and agencies (D.I.A.N.D., D.O.E., N.E.B., etc.). Therefore, an independent Board concept was recommended and subsequently funded by Mr. Blair. In 1970 Templeton Engineering turned this work over to a subsidiary, Inter-disciplinary Systems Ltd., who annually reviewed the premise that a pipeline can be accepted if certain terms and conditions are met. To date, the review indicates that if the conditions are met, a gas pipeline could be built with an 'acceptable' amount of environmental damage. Vol. 46
6034-6040
- The Board is made up of 7-8 members who, as explained by Mr. Templeton, have one particular field of expertise and a broad scope in other fields (the 'T' shaped man). Vol. 46
6041-6042
- The objectives of the EPB, as outlined by Mr. Templeton were: (1) to promote openness, (2) to promote discussion of environmental matters at the pipeline company, the government and the public levels, (3) to develop a methodology for converting environmental research into environmental protection measures and controls, (4) to publish an environmental impact assessment, (5) to maintain construction, and, (6) to make a post construction evaluation. Vol. 46
6042

b-2 Approach to the Problem

- The environment and native people - environment relationships were the only aspects addressed by the EPB, according to Mr. Templeton. A universally accepted impact assessment methodology has not been established. The primary environment effects are difficult to predict not to mention the secondary and tertiary effects. Assumptions have to be made on what man will do. Therefore, to predict an impact, assumptions must be made of the performance of the applicant and the government. With these assumptions, the EPB prepared a matrix of environmental concerns with axes showing 218 construction activities and 57 environmental components resulting in a matrix of 12,426 primary concerns. The concerns were coloured red, yellow or white depending on order of seriousness defined by judgement. Although 'worst case' regional impact matrices (assuming little control) were prepared, the EPB atlas showed only the "probable" (based on assumed controls) regional impact matrices. The regions identified were: (1) Delta, (2) Coastal (Yukon), (3) Interior (Yukon) (4) North Mackenzie and (5) South Mackenzie. Maps were prepared to visually portray the environmental and project components of the proposed activity. A 'flag' system on those maps was used to note environmental dangers. At this stage the EPB was in a position to write its report on the likely impact assuming the specified control of the work by the government and the applicant. Vol. 46
6042-6057
- The applicant's control of the project, as explained by Mr. Templeton, is suggested in their application but nowhere are the governmental controls disclosed. Therefore, Volume 2 of the EPB series, entitled "Towards an Environmental Code", spells out the performance levels required by both the applicant and the government. Vol. 46
6057
- Arctic Gas's application could be acceptable environmentally if the restraints noted by the EPB are enforced. The inadequacies of the application and the government control as outlined in the EPB reports must be resolved before the start of the project. Vol. 46
6057-6058
6033-6034

b-3 Relation to the Sponsor

- Through various sponsor companies (AGTL, Gas Arctic Systems, CAGSL) since 1970, the EPB maintained complete autonomy and freedom from sponsor censorship, according to Mr. Templeton. Vol. 46
6058-6064

b-4 Work of the Board

- The work of the Board, as described by Mr. Craik, covered three areas: 1) field and office research, 2) advice to their sponsor and, 3) external public role. The field and office research was conducted in 1971 and 1972 and included studies on the Porcupine caribou herd, waterfowl, fish, plant communities, revegetation, geotechnical and hydrological topics, winter roads, fires, native peoples' use of resources and archaeological sites. In its advisory role, the EPB participated in numerous meetings with Arctic Gas and its predecessors including the April 1973 meeting where environmental trade-off decisions were made. The EPB also produced Vol. 46
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Vol. 46
6079-6088

b-4 Work of the Board (Cont'd.)

the 'Guidelines for Environmental Training of Construction Workers' for Arctic Gas. In its external public role the Board produced reports and newsletters and conducted one workshop on the philosophy of environmental impact. Its final impact assessment was issued in 4 volumes in 1974: Volume 1, Summary of Impact Predictions and General Conclusions; Volume 2, Toward an Environmental Code; Volume 3, Environmental Atlas and; Volume 4, Research Reports (forming the basis for Volumes 1 to 3).

b-5 Impact of the Projectb-5-1 Introduction

- A regional ecological system approach was developed as outlined by Mr. Templeton, using subjective terms (severe, moderate, minor) for impact under twelve headings: (1) land in its natural state, (2) northern peoples, (3) birds, (4) mammals, (5) fishes, (6) vegetation, (7) archaeological resources, (8) air, (9) water (10) terrain, (11) total impact of project, (12) cumulative impact of this and following projects. The assessment was confined to the Canadian trunkline itself and did not examine the socio-economic aspects except as it affected native peoples as users of biological resources. The assessment was limited by: (1) the uncertainties of government and applicant accountability for environmental change (2) the limits of the baseline data, (3) the complexity of the environment and (4) the unpredictable nature of personnel associated with the project. The impact would be very different than shown (more severe) if the assumed rigid seasonal construction constraints were not met.

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b-5-2 Terrain

- One of the most significant impacts, according to Dr. Adam, would be on the terrain with particular emphasis on the surface and slope stability. Other terrain related areas of concern were frost heave, drainage disruption, winter roads, clearing, grading, burning, borrow pits, ditching, river crossings and pipeline operation. The probable regional impact matrix showed a potential for major impact as far south as Willowlake River. The interior route was preferable from a terrain point of view. In the boreal forest and forest tundra regions (north of Norman Wells) clearing would cause surface subsidence from 1 to 3 feet. No noticeable degradation is anticipated on the tundra. Icing problems at river crossing were viewed as probable north of the Ochre River. Severe disruption of drainage and frost heave problems resulting from chilled pipeline induced permafrost was forecast south of Willowlake River. In this area, it was suggested that small rivers be traversed using overhead crossings, larger rivers be monitored and the pipeline be operated above freezing temperatures. The Board agreed with the viability of winter (snow) roads but suggested that, on the basis of their examination of temperature and snowfall records, this technique could be used as far south as 63° as opposed to the 65° limit given by Arctic Gas. This would, of course, be dependent on careful control in the event of unseasonal thaws etc.

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b-5-3 Vegetation and Air

- The role of vegetation in northern forested and arctic areas was outlined by Dr. Bliss. With proper controls and using the interior route, the potentially large impact of the pipeline could be significantly reduced. Properly constructed and regulated winter (snow) roads would have little lasting impact on vegetation but should be kept to wet lowland areas wherever possible. The potential impact resulting from emergency repairs, erosion, fire and the role of revegetation was outlined. The air quality impact of the pipeline would be small compared to the gas plants and the activities following the pipeline such as mines, roads, towns, etc. Dr. Bliss emphasized the importance of wilderness and ecological reserves in the North pointing out that there were eight proposed International Biological Preserves close to the right-of-way as shown on the EPB atlas. These preserves and the proposed Yukon Wildlife Range should be set aside. There were no known rare or endangered species of plant or plant communities along the route. In conclusion, Dr. Bliss stated that (1) winter roads be used and carefully controlled, (2) summer traffic be limited and, where necessary, LGP vehicles be used, (3) clearing slash be chipped, not burned, (4) fires were of no great concern if they didn't threaten the pipeline and, (5) more research was required on (a) cold pipeline effects on vegetation (b) techniques to skim off and replace the vegetative mat, and (c) slope stability procedures.

b-5-4 Aquatic Environments

- The aquatic environment impact was described by Dr. Wilimovsky. Based on aquatic considerations the coastal route was superior to the interior route. The main concerns were fish habitat changes such as: (1) sedimentation, (2) water quality (oxygen), (3) toxic spills and, (4) effects of increased harvest. The main construction concerns incorporated into the watershed matrix analysis were: (1) roads and gravel removal (sediment), (2) river crossings (obstruction and sediment), (3) spills, (4) explosives and, (5) improved access and its effect on harvesting. Interactions were characterized as short or long term depending on the species' life stages and ability of the species as a whole to recover. In this respect the timing and duration of construction, and subsequent activities such as looping, are important. The situation effects of: (a) gravel harvesting, washing and use in making concrete weights and (b) river crossings were described as well as the obstruction effects of river crossing construction and culverts. The toxic effects of the methanol disposal proposed cannot be assessed with existing data. Sport fishing was not viewed as harmful but rather was suggested as a means of collecting data. The use of explosives was studied in detail with the conclusion that summer blasting could be done with precautions. No unclassified

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b-5-4 Aquatic Environments (Cont'd.)

documents were known describing the effects of under ice explosion but it was estimated that this would have a somewhat greater effect on fish and a significantly greater effect on mammals. In summary, Dr. Wilimovsky described the aquatic impact of various transportation corridor developments as: (a) gas pipeline = 1, (b) oil pipeline = 3 to 5 times (a) and, (c) road 6 to 10 times (b). The overall aquatic effect of the Arctic Gas proposal was considered minor although some short term serious impacts could be expected.

b-5-5 Birds

- The impact on birds was described by Dr. McTaggart-Cowan. Only 12 species of 200 in the area will be significantly affected in the long term by the three main impacts: (1) pollution, (2) habitat alteration and, (3) disturbance by aircraft, and ground vehicles. It was emphasized that the assessment was for a gas pipeline only and the conclusions were not applicable to other corridor components (highway, oil pipeline, etc.). The critical life cycle timing of northern birds in migration, and mating make it critical that disturbance be minimized by limiting the altitude of overflights and ground access in areas such as the Mackenzie River Islands, the Yukon coastal spits and Islands, the Delta and the Old Crow Flats. Of particular concern are the raptors - golden eagles, bald eagles, gyrfalcons and peregrine falcons. In the case of falcons, it is recommended that the pipeline detour $2\frac{1}{2}$ miles from any nesting sites, overflights be greater than 2,000 feet and compressor stations be located at least 5 miles from the sites. The concern for pollution by spills is centered on the Delta where containment lead time wouldn't be sufficient thus destroying food chains, and killing birds. Detailed contingency plans must be developed. The interior route is preferable as far as bird impact is concerned, according to Dr. McTaggart-Cowan. Throughout the project a strict code of behaviour must be enforced to control the human impact on the birds. Many of the bird-related environmental conflicts can be avoided by careful route selection, scheduling and construction planning.

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b-5-6 Mammals

- The impact on mammals was described by Dr. McTaggart-Cowan. The impact on the 63 species in the pipeline area would be confined to 13 species plus 5 marine mammals. The impact would result from: (1) direct killing due to increased access, (2) disturbance and access, (2) disturbance and harassment and (3) habitat alteration. The impact would be less in the Mackenzie Valley than in the Northern Yukon since the mammal distribution differs in those two areas. The 100,000 head Porcupine caribou herd has survived because of its isolation. The impact on moose, grizzly, bear, Dall sheep, polar bear, wolverine and wolf was described along with specific recommendations to minimize that impact for each mammal. In summary these recommendations were: (1) conduct careful

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b-5-6 Mammals (Cont'd.)

- monitoring of the caribou both during and after construction to detect changes, (2) stop construction and fill the trench in the summer and fall to avoid caribou migration conflicts, (3) avoid blasting near to calving and post calving herds, (4) prohibit firearms on pipeline construction and operation except for sealed weapons used for protection, (5) limit overflights to 2,000 ft. or greater, (6) penalize people harassing wildlife, (7) dike all fuel storage facilities (8) develop spill contingency plans, (9) prohibit and penalize waste discharge (10) avoid roads across Dall sheep areas, (11) use noise abatement devices on all equipment within 2 miles of Dall sheep wintering areas, (12) incinerate all garbage, (13) avoid timber clearing of areas greater than 300 acres, (14) establish a wolf management program, (15) establish no hunting zones 2 miles or more on either side of the right-of-way and roads except for previously established traplines.
- The knowledge of marine mammal impacts is not sufficient to make an assessment. Beaver and muskrat would be vulnerable to oil spills but, in general, construction wouldn't affect a very substantial part of their habitat. The impact on caribou could be serious if activities were not properly regulated. Moose habitat would be changed although such change wouldn't be all negative. A decline in the grizzly bear population is inevitable. The impact on Dall sheep would be largely around Mount Good Enough but they would adapt to the change - mostly noise.
 - The impact on caribou was pursued by the Judge. The interior route would intercept the migration of the herd and the coastal route would disturb the calving grounds. The Porcupine herd was one of 4 caribou herds in existence - 2 of which are in Canada. It consists of about 100,000 animals of which 2,500 to 4,000 are killed annually. Recent data indicate that the herd size may be increasing. Dr. McTaggart-Cowan stressed that unless rigid controls are developed and enforced he anticipates a depletion of the herd.

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6225-6227b-5-7 Land in its Natural State

- As trustees for future generations we are responsible for maintaining an unused wilderness bank account, said Mr. Templeton. He went on to quote "Something will have gone out of us as a people if we ever let the remaining wilderness be destroyed, if we ever permit the last virgin forest to be turned into comic books and plastic cigarette cases, if we drive the few remaining members of the wild species into zoos or to extinction, if we pollute the last clean air and dirty the last clean stream and push our paved roads through the last of the silence so that never again will Canadians be free in their own country from the noise, the exhausts, the stinks of human and automotive wastes, and so that never again can we have the chance to see ourselves single, separate, vertical, and individual in the world, part of the environment of trees and rocks and soil, brother to the

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6227-6238

b-5-7 Land in its Natural State (Cont'd.)

other animals and part of their natural world and competent to belong to it."

The impact of the gas pipeline will be minor compared to the Highway, oil pipeline, hydro transmission lines etc. which will follow. The recreational role of northern lands is expected to be great and development will conflict with this use particularly on the unique Yukon coastal plain, the north Porcupine River, the Old Crow Flats, and the west side of the Delta at the base of the Richardson Mountains. Land use planning is the only recourse to guarantee our responsibility to future generations to maintain land in its natural state. The impact of the Arctic Gas project on land in its natural state is negative.

b-5-8 Total and Cumulative Impact

- The total and cumulative long term impact will be greater than the sum of the individual impacts, according to Dr. McTaggart-Cowan. Because of the complexities of nature, and peoples' lives one cannot foresee all the effects. Chain reactions are easy to start. For example, a change in the caribou affects all those other animals, including man, who depend on them. The gas pipeline would be followed by others (Beaufort Sea Oil, gas plants, highways etc.) and we would get "destruction by insignificant increment". Therefore, a comprehensive land use plan for the Yukon and N.W.T. is necessary. On this project, rules will be bent to get the job done and hence cause environmental damage. Without a clear and responsible authority, unforeseen impacts will go unchecked. Before the pipeline is approved, a comprehensive land use plan and objectives must be prepared otherwise destruction similar to that following Canada's railroads into the west would develop. Were the problems of native claims, the buffalo, the vast grass lands, etc., dealt with properly?

Vol. 47
6263-6275
- The Judge asked the Board's opinion on looping and other corridor developments referred to in the Guidelines (1972). According to previous evidence by Mr. Horte looping could begin within 4 years of the original construction. Mr. Templeton emphasized that the Board's analysis did not consider this. The impact of looping would probably be similar to the initial construction.

Vol. 46
6096-6101
- The Board's view was that there was insufficient information on looping to do an impact assessment. Mr. Templeton pointed out that despite several letters to the Prime Minister and others no studies were ever made to justify a corridor concept. A similar situation was described relative to the highway. The acceptance of one facility in a corridor would imply acceptance of a multi-facility corridor. This would have a serious effect - particularly in the northern Yukon - and should not be accepted until it is properly studied. The inevitability of looping, a hot oil line, etc., should not be

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6441-6449

b-5-8 Total and Cumulative Impact (Cont'd.)

accepted. If looping is an integral part of this pipeline, insufficient evidence is available to make an environmental impact assessment.

b-6 Existing Framework for Environmental Protectionb-6-1 Introduction

- The applicant must give commitments, not assurances, if a proper environmental assessment is to be made, according to Mr. Templeton. In the North, the law "If anything can go wrong, it will go wrong" particularly applies. The EPB agreed that the pipeline could be built with an acceptable degree of environmental change. However, it did not think it likely that such change would be restricted to their definition of acceptable. Therefore, it began addressing those laws, regulations, duties and responsibilities of the applicant, the government and the public required to control the environmental degradation to an acceptable amount. Vol. 47
6280-6285

b-6-2 Applicant

- Although the applicant has demonstrated an awareness of the environment, this has not been translated into environmental regulations, according to Mr. Templeton. This is demonstrated in the lack of specific regulations for aircraft flights, fuel handling, wharf construction and off right-of-way activities. Time will be required to develop these regulations and communicate them to prime and sub-contractors and unions. The applicant's exhibits are lacking. They say "can" rather than "will", "in general", "where necessary". The good will of the applicant and his contractors isn't sufficient particularly in the North. Similarly, environmental training of personnel is promised. Manuals and training must be available now if the proposed schedule is to be met. Vol. 47
6285-6298

b-6-3 Government

- Forty-four existing laws and regulations that will apply to this project were listed by Mr. Craik, and in his view, they are unlikely to be effective in controlling a project of this scale. Using the time required to develop the existing land use regulations as an example, (2 years and 20 drafts) he emphasized that there was insufficient time to develop new laws. His assessment of past performance of the various departments led him to the conclusion that existing penalties do not act as deterrents. This situation is aggravated by the development and environment conflicts within D.I.A.N.D., and the little-defined D.O.E. responsibilities in the Territories. The present government framework is incapable of ensuring environmental protection on this size of project. The authority must be drawn together for proper control of the pipeline. Vol. 48
6315-6327

b-6-4 Public

- A formal independent body to carry out a continuing assessment and public reporting of the environmental aspect of this project is required, according to Dr. Wilimovsky, to assure public accountability. Vol. 48
6327-6329

b-7 Recommendationsb-7-1 Applicantb-7-1(a) Introduction

- Before granting of a right-of-way permit Mr. Templeton urged that the applicant must: Vol. 48
6330-6332
 - (1) submit detailed plans showing it will protect the environment, (2) specify its formal environmental training program and, (3) demonstrate that supervision and accountability for environmental protection measures will be through the same person who supervises the engineering and economic aspects.

b-7-1(b) Applicant's Plans and Specifications

- The applicant should be required to produce according to Dr. Wilimovsky, detailed contingency plans for (1) fires, (2) toxic spills, (3) rupture of the pipeline in summer, (4) aircraft control mechanisms (with D.O.T., etc.), (5) disposal of test fluids, (6) snow road failures and (7) delays caused by early breakup of later freeze up. Vol. 48
6332-6334

b-7-1(c) Applicant's Environmental Training

- The applicant should be required to table its environmental training schedule and course details, according to Mr. Gourdeau. Noting that most of the environmental damage results from the procedures of the project personnel, it was suggested that training be keyed to five levels according to the employees' damage potential: (1) mainline workers, supervisors and camp builders, (2) supply and logistics teams, (3) senior administrative personnel, (4) inspectors and (5) operations and maintenance staff. Development of such a program could take up to one year. Vol. 48
6334-6340

b-7-1(d) Applicant's Environmental Supervision

- The applicant must be responsible for environmental protection through the same office that is responsible for engineering and economic management of the project, according to Mr. Gourdeau. The inspectors must be incorporated into all levels and specializations. This balance must exist throughout the program down to the small scale local activities. Vol. 48
6340-6344

b-7-2 Governmentb-7-2(a) Introduction

- The Mackenzie Valley Highway was cited by Mr. Templeton as an example of poor environmental performance by government. He Vol. 48
6344-6346

b-7-2(a) Introduction (Cont'd.)

recommended (1) a land use plan be prepared for the western arctic, (2) an environmental training and inspection system be established and, (3) a single agency be developed to implement an environmental code.

b-7-2(b) Land Use Planning

- A long range land use plan is required now, before piecemeal degradation limits future options, according to Dr. Bliss. Sufficient data is available now. The plan, developed by an inter-disciplinary group of recognized experts, should be produced by the Federal Government in co-operation with the Territorial Governments. It would consider northern limits for agriculture, forestry and wildlife species, reflect recreational and scenic values and include land in its natural state, National and Territorial Parks, areas of mining, hydro and petroleum development. Vol. 48
6346-6353

b-7-2(c) Environmental Training and Supervision

- The first responsibility of the single controlling agency of government should be the establishment of a rigorous training program, according to Mr. Gourdeau. It would be mandatory for all government inspectors and could possibly parallel the applicant's program. It would include project appreciation, laws, procedures, and the proposed code. Vol. 48
6354-6356

b-7-2(d) Government Agency

- The EPB recommended the establishment of a single control agency and a code, as described by Mr. Craik, because of the scale, timing and complexity of the project. This agency would be established by law for this particular project only to enforce all existing regulations and the proposed code. It would consist of authorized officers (inspectors) reporting to the agency director would be responsible to a Cabinet Minister. The agency would have the power to suspend activity. Its structure would parallel that of the applicant and it would: (1) approve preliminary designs (180 day assessment period), (2) approve detailed working schedules and (3) approve field designs. It would issue a notice to proceed for each aspect of construction subject to a 90 day review period. Vol. 48
6357-6372
- Government regulations in a form similar to the EPB code, and drafted specifically for this project, are necessary. This is the basic tool to ensure environmental protection.
- Mr. Craik, in answer to the Judge's questions, acknowledged that, south of 60°, negotiation with the provinces would be necessary if the agency were to have jurisdiction there. The NEB could be the agency, as suggested previously by Mr. Horte, if it drew on personnel from other departments. It was Mr. Craik's opinion that D.O.E. should be granted more and more authority in the North.

b-7-2(e) Public

- An independent, objective reporting by a small environmental auditor group of high stature individuals was recommended by the EPB and described by Dr. Wilimovsky. It would have no line function in the regulatory agency and would not intrude on the government's role.

Vol. 48
6373-6374b-8 Environmental Codeb-8-1 Introduction

- An environmental code must be adopted before the project is approved, according to Mr. Templeton. Recognizing the timing problems this imposes, the EPB prepared a 'first draft' of such a code which is Volume 2 of their final report series. It was prepared by 13 engineers and ecologists and spells out project performance requirements in detail under the following headings:*

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6374-6381Vol. 48

b-8-2 Environmental Training and Briefing of Staff	6381-6385
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b-8-16 Explosives	6413-6416
b-8-17 Fire Contingency Plan	6416-6417
b-8-18 Fuel Storage and Handling	6417-6420
b-8-19 Termination of Use of Temporary Facilities and Restoration	6420-6422

* Author's Note:

The sections of the code were read into the record (either in full or in summary) from the EPB Vol. 2 - Towards an Environmental Code. It is not repeated in this summary. However, it is important that this be reviewed in detail either directly from the EPB publication or by reference to the relevant pages noted in Vol. 48 of the transcripts.

b-9 Timing, Effort and Urgency of Establishing Regulatory Agency

Vol. 48
6423-6436

- The Normandy landing is analogous to this project, according to Mr. Templeton. The planning and control mechanisms can't be set in motion after the project is approved. A well disciplined organization under one supreme commander is required to control the activities. D.I.A.N.D., D.O.E., N.E.B. and E.M.R. each have their own hopes and unique staff which must be blended into one agency by a political decision by government. This could take 6 months to a year. Add to that 2 to 6 months to second senior management, another 2 to 6 months to obtain senior technical people, familiarization time, 6 or more months to update the code and the urgency of the matter can be appreciated. The agency must start now so that it is operating efficiently by the time the Inquiry rulings are made. The applicant will soon be making important decisions on equipment and scheduling that will affect the environmental impact, and these decisions must be influenced by the controlling agency. Two immediately important agency responsibilities are: (1) development of the timing of basic decision points on a critical path chart so that impact can in fact be controlled by such things as equipment types purchased, crew sizes, etc., and, (2) preparation of detailed specifications and trained staff so that shutdown powers are rarely used. Exercising such powers could cause more environmental damage than they prevent.
- This Inquiry has the option to say 'no pipeline' or no pipeline until the land claims are settled, according to Mr. Templeton.
- Government bureaucrats (not elected officials) should be required to appear at the Inquiry to outline what the government plans to do. This is as important as what the applicant plans to do. As things now stand both the applicants and government's actions are variables and there is no other forum to question these actions. The EPB made assumptions but questions which must be answered by the government include: (1) What authority do the various departments have?, (2) Will a single control agency be set up? How long will it take to do so?, (3) Have departmental inspection roles been defined? What are they?, (4) What staffing is planned?, (5) Can Cabinet transfer authority from various departments to a single agency or department?, (6) Is legislation necessary to form a new agency with real regulatory powers?, (7) How long would it take to set up such an agency? (8) Will an environmental code be established and enforced?, (9) How long will it take to approve such a code?, (10) Is long range Territorial land use planning the responsibility of D.I.A.N.D.?, (11) What effort is currently being expended on such a plan?

b-10 Summary

- A government mechanism to approve the applicant's plans as they are developed and a public monitoring group are required, according to Mr. Templeton. The EPB's recommendations are contained in Volumes 1, 2 and 3 of their final report series. These cover three levels
 - (1) Policy Level:
 - a) a single agency to administer all laws of this project,
 - b) an environmental code,
 - c) an independent auditor group,
 - d) a land use plan, and
 - e) settlement of native land claims.
 - (2) General Level:
 - 1) The Cross Delta, Fort Simpson and looping aspects should be deleted from consideration at this time since there is insufficient information,
 - 2) the EPB Volume 2 be incorporated into an environmental code,
 - 3) the gas not be chilled below freezing south of Willowlake River.
 - (3) Site Specific Level:
 - 1) The recommendations shown in EPB Volume 3 be incorporated into the project control mechanisms.

Vol. 48
6436-6450

The project is environmentally acceptable to the Board subject to the conditions outlined in the code. This does not infer that the damage will be acceptable since enforcement procedures by the government and applicant are unknown.

- The Judge questioned Mr. Templeton on the Board's position after pointing out Mr. Horte's statement of May 24th indicating that Arctic Gas felt that the NEB should be the single agency to control the project. Mr. Templeton explained that the pipeline is only acceptable under certain conditions such as (1) controls by government and applicant, (2) a general land use plan upon which to build and, (3) the settlement of land claims before the pipeline begins.

Vol. 47
6275-6280(c) Socio-Economicc-1 Land and Northern Peoples

- The land-man relationship for native peoples provides the cornerstone to their culture and is an integral part of their sense of being, according to Mr. Gourdeau. It underlies their reactions to life and philosophy of existence. It is not limited to the economic use of the land. The pipeline related employment could provide a supplement to the bush related income for those people living in the smaller communities. For those in the larger communities whose day to day relationship to the land is not as intense, the number of job opportunities filled by natives could be significant if an employment scheme such as Panarctic's is any indication. Those who

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6240-6258

c-1 Land and Northern Peoples (Cont'd.)

are younger than 30 will find it difficult to return to hunting/trapping. Those who are older than 30 will probably have limited participation and will suffer because of their small income compared to those working on the pipeline.

Archaeological evidence obtained as part of the construction should remain in the North. The reaction of the native people to the pipeline must be understood in light of the following:

(1) ownership of the land has not been questioned before and only recently have native peoples realized that outsiders could limit their use of the land, (2) the dominance of outsiders is apparent and land - the natives' only possession - is taken away or its ownership is being questioned; (3) the awareness of natives has been highlighted by the Alaskan settlement and the agreement in principle in Quebec, and (4) the Nishga Case on aboriginal rights has come to the forefront.

Settlement of land claims will be the determining factor in the pipeline impact. If no settlement or a poor settlement is reached, a negative impact can be predicted similar to James Bay where natives boycotted the project. A positive impact can be predicted if the land claims are settled, the company abides by its promises on recruitment etc., and the government gives some responsibility to natives in a supervisory function of the natural environment and community services, co-ops, etc., are given benefits.

Time is required to allow the northern culture to evolve or cultural genocide will result. Natives must be able to participate without the loss of their cultural identity. This is an integral part of northern development and is to the benefit of all Canada. If this does not happen, and the only profit is from salaries, the native culture will disintegrate.

- The Judge questioned Mr. Gourdeau on the Native boycott of the James Bay project. This was done as an act of solidarity to protest the land claims agreement, according to Mr. Gourdeau. He went on to explain the problems with the agreement and the native situation in New Quebec.

Vol. 47
6259-6262

(d) Miscellaneousd-1 EPB Funding and Cost

- The Board's funding has come from the pipeline proponents - either Arctic Gas or its predecessors, since 1970. The \$3 million expended to date have been used to finance the work the Board decides is necessary independent of its sponsor.

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6088-6090

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 68 AND 69)

ENVIRONMENT PROTECTION BOARD
YELLOWKNIFE, N.W.T.
SEPTEMBER 24 and 25, 1975

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TOPIC: Environment Protection Board

DATE: September 24 and 25, 1975 in Yellowknife.

WITNESSES: EPB panel member (recalled) to deal with Phase I evidence only.

- C.H. Templeton: President, Templeton Engineering and Chairman of the Environment Protection Board (EPB)

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

- nil

B. Environmental

b-1 Developing Terms and Conditions

- The EPB Code was developed because the Board realized that one had to be specific when dealing with pipeline companies and contractors and their contracts and specifications, according to Mr. Templeton in cross-examination by Commission Counsel. The code was written for the people in the field who would have to use it, in language they would understand. A social code should be developed as well. The title "Towards an Environmental Code" was chosen because the Board realized that it was not final - but it should be considered as a first draft for the Inquiry to work from. Specific terms and conditions should be developed now. The code should be a 'performance code' and not a detailed explanation of how to do the work. Site specific information could be supplementary to the code such as is contained in the EPB atlas. Vol. 68
10223-10230
- Each participant should list their terms and conditions for phase one and these should be argued before the Inquiry so that it becomes clear what specifically is going to be done, according to Mr. Templeton. Environmental problems are complex and are not conducive to breakdown into 4 phases. Vol. 69
10231-10233
- Environmental problems are complex and are not conducive to breakdown into 4 phases. Vol. 68
10186-10187

b-2 Regulatory Agency

- One agency with the expertise from all departments of government should be formed and designed so that it would self destruct at the end of construction, according to Mr. Templeton in cross-examination by ITC/COPE. Looping and an oil pipeline would be other projects and shouldn't be of concern to the agency. The NEB may have environmental and social expertise sometime in the future to handle such projects. The agency should report to a Cabinet Minister and a small environmental auditing group should be formed to report to the public on the performance of the pipeline company and the regulatory agency. Vol. 68
10193-10202

* Note: Summary #9 incorporated the EPB's evidence in chief only. This and subsequent supplements will cover the cross-examination of the EPB panel members.

b-2 Regulatory Agency (Cont'd)TRANSCRIPT
REFERENCE

- The Judge outlined his understanding of the powers of the inspectors in Alaska to shut down the Alyeska work under the authority of the Department of the Interior. Mr. Templeton pointed out that the fragmentation of authority between departments in Canada makes a similar approach impractical. A single agency in Canada is the only way. Vol. 68
10202-10205
- An agency for North of 60° and another one for South of 60° may be required because of the way the laws are set up, according to Mr. Templeton in cross-examination by Arctic Gas. A single agency for both would be preferable. Vol. 68
10209-10214
- The regulatory agency should report through a Minister rather than to a Minister, in a way similar to the NEB, according to Mr. Templeton in cross-examination by Commission Counsel. The Agency should be located where the pipeline company is located. Vol. 68
10221-10223

b-3 Enforcement

- Monetary controls should be placed on the contractor to compel compliance with regulations, according to Mr. Templeton in cross-examination by the NWT Indian Brotherhood/Métis Association. Shutting a project down is difficult and could lead to environmental damage. A performance bond equal to one percent of the cost of the project should be posted with the regulatory body. This would act as a deterrent. The existing regulatory agency would prevent the company from passing the cost of bonding on to the consumer. Vol. 68
10188-10193
- The administration of a performance bond to enforce compliance was questioned by Arctic Gas. The problem would be to assess the monetary value of irreplaceable damage to the environment. Vol. 68
10208-10218
10214-10218

b-4 Miscellaneous

- The role and involvement of Drs. Thompson and Adam and the commitment of the EPB to the contents of their reports was questioned by Arctic Gas in cross-examination. Vol. 68
10218-10221
- No attempt was made to silence the EPB by changing their terms of reference, according to Mr. Templeton in cross-examination by Foothills. Vol. 68
10205-10208

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT NO. 72)

ENVIRONMENT PROTECTION BOARDYELLOWKNIFE, N.W.T.
OCTOBER 15, 1975

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TOPIC: Environment Protection Board
Cross-examination of Dr. Adam on Phase I Evidence

DATE: October 15, 1975 in Yellowknife

WITNESS: EPB witness:

Dr. K. Adam: Associate Professor of Civil
 Engineering, University of Manitoba.

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Engineering/Technical

a-1 Frost Heave

- Chilling of the pipeline should stop near the Willowlake River, according to Dr. Adam when asked by the Judge to comment on the apparent discrepancies between Dr. Peter Williams' evidence (see Summary #35) and the views held by Arctic Gas. Dr. Adam said he concurred with Dr. Williams' views although in his view it wasn't an issue "on which the project hangs". It is a matter of trade-offs between the unknown dangers of frost heave in discontinuous permafrost and the known problems associated with thaw settlement. From an environment viewpoint, the "worst case" of settlement is better than a "worst case" of frost heave. Based on the available drill hole information (quoted by Dr. Adam) the chilling should stop in the Willowlake River area. If there were a frost heave problem north of there Arctic Gas would have the option of simply shutting down the chillers. Dr. Adam said he agreed that the shut-off pressures have been underestimated by Arctic Gas and NES although there is some doubt that they are as high as the laboratory results quoted by Dr. Williams. Vol. 72
10778-10787
- Although the view that NES has underestimated the magnitude of the pulling forces is shared by himself and independent test labs, this has not been discussed by the EPB, according to Dr. Adam in cross-examination by Arctic Gas. The view was reinforced after looking at the results of the Calgary Test Site. The application of loads had little effect on heave. The concept of separating pore water volume expansion and ice lens formation also is questionable. These two doubts were discussed with the chairman of the Environment Protection Board (EPB). Vol. 72
10788-10793
- The bore hole information made up from the 1200 to 1300 hole logs that have been recently made available from the Mackenzie Highway work, reinforce the EPB's view that chilling should stop where they have recommended, according to Dr. Adam in cross-examination by Arctic Gas. Arctic Gas suggested that there are six other factors which must also be considered: (1) the aerial distribution of permafrost, (2) the Vol. 72
10793-10799
- The bore hole information made up from the 1200 to 1300 hole logs that have been recently made available from the Mackenzie Highway work, reinforce the EPB's view that chilling should stop where they have recommended, according to Dr. Adam in cross-examination by Arctic Gas. Arctic Gas suggested that there are six other factors which must also be considered: (1) the aerial distribution of permafrost, (2) the Vol. 72
10799-10804

a-1 Frost Heave (Cont'd.)TRANSCRIPT
REFERENCE

permafrost depth and ice content, (3) the frost susceptibility of the unfrozen soil, (4) the pipe-soil interaction, (5) the stability of slopes and (6) the drainage and erosion control problems in thawing as opposed the freezing soils. Dr. Adam maintained that enough information on these six points was available for the EPB to make their recommendations from an environmental point of view. The fifth point was not studied in detail.

a-2 Snow Roads

- The EPB criticism (with respect to snow roads) that the work wasn't scheduled to start early enough, was based on a different construction schedule than CAGPL now proposes, according to Dr. Adam in cross-examination by Arctic Gas. The more recent schedule rectifies this problem.

Vol. 72
10804-10812B. Environmental

nil

C. Socio-Economic

nil

D. Miscellaneous

- The cross-examination of Dr. Adam was interrupted so that Arctic Gas could put forward its rebuttal evidence on frost heave. The cross-examination will continue when Dr. Adam returns in Phase II.

Policy and Planning
(ACND) Division
October 28, 1975

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 107, 108 AND 109)

Cross-examination of the Environment
Protection BoardYellowknife, N.W.T.
January 12 - 14, 1976TABLE OF CONTENTS

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TOPIC: Phase II and III: Impact of the Proposed Pipeline and Mackenzie Corridor Development on the Physical and Living Environment.

Cross-examination of the Environment Protection Board

DATE: January 12, 13 and 14, 1976 in Yellowknife.

WITNESSES: Panel representing the Environment Protection Board (EPB)

Mr. C.H. Templeton:	President, Templeton Engineering and Chairman of the Environmental Protection Board (EPB).
Dr. L.C. Bliss:	Professor of Botany, University of Alberta.
Dr. I. McTaggart Cowan:	Professor of Zoology, University of British Columbia (U.B.C.)
Mr. D.W. Craik:	Consulting Engineer and M.P.P. (Manitoba).
Dr. N.J. Wilimovsky:	Professor of Faculty of Graduate Studies, Institute of Resource Ecology and Curator of Fishes, U.B.C.
Mr. E. Gourdeau:	Consultant (Forestry and Economics and guest lecturer at Laval and Sir George Williams University.
Dr. K. Adam:	Associate Professor of Civil Engineering, University of Manitoba.
D.S.S. Thomson:	Department of Civil Engineering, University of Alberta.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 Chilled Pipeline

- The drainage problems relating to the use of a chilled gas pipeline have not been satisfactorily solved, according to Dr. Adam in cross-examination by CARC. The insulated culvert idea for handling subsurface drainage won't work. The whole problem could be alleviated somewhat by changing the point of chilling cut-off.	Vol. 107 16339-16340 16346-16354
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B. Environmental

b-1 Impact - General

- Six assumptions on which the EPB based its prediction of impacts, according to Mr. Templeton in cross-examination by ITC/COPE, were: (1) the pipeline will be built as the engineers say it can, (2) the engineers mitigative measures can adequately deal with any technical problems that may arise, (3) the pipeline employees can be controlled as Arctic Gas says they can, (4) the pipeline will be built in isolation from a road across the north slope, (5) the project can be	Vol. 107 16365-16369 16376-16378
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stopped for compelling environmental reasons and (6) the government can regulate the project as suggested.

- The EPB used the best environmental assessment technique considering the time available and the general lack of data, according to Dr. Wilimovsky in answer to CARC's reference to Dr. Banfield's general criticism of the EPB approach. Dr. McTaggart-Cowan pointed out that the EPB used all the data that was available to Banfield and others. Mr. Templeton pointed out that a more quantitative assessment wasn't possible because of the lack of data. Arctic Gas' work was also, therefore, a subjective evaluation. In cross-examination by ITC/COPE, Dr. McTaggart-Cowan explained how the work had to start with baseline data and "opening" experiments. The EPB work was an independent assessment and wasn't a criticism of the CAGSL work. Different conclusions were reached in places because of subjective evaluations. There are many areas of disagreement. Vol. 107 16352-16359
- The cumulative impacts of developments such as an oil pipeline, road etc. were not studied by the EPB but are of great concern, according to Mr. Templeton in cross-examination by CARC. The EPB is adamantly opposed to both an oil pipeline and a road. One of the terms and conditions of a gas pipeline should be that they are prohibited. Dr. Bliss described a tentative attempt to quantify impacts which lead to a slight favouring of the coastal route. Mr. Templeton said that the Board opposed any corridor along the North Slope of the Yukon and across the Interior. Vol. 107 16305-16311
- The cumulative effect of impacts makes the time interval before looping is permitted critical, according to the panel in cross-examination by Commission Counsel. Areas of particular concern are: (1) drainage disruption, (2) wetland areas and the Ramparts River area, and (3) caribou herd expansion into the Mackenzie Valley. The monitoring of the first pipeline would pin-point areas of concern so that recovery time could be assessed for subsequent development. A new project like an oil pipeline would require a new right-of-way and therefore would require a new assessment. Dr. Wilimovsky explained his relative impact rating of oil and gas pipelines and highways. Dr. Thomson suggested that the gas pipeline will be the ultimate experiment. In conclusion Mr. Templeton said that if looping will occur, the project description is inadequate and should be rejected. The next project shouldn't occur for about 10 years. Vol. 108 16533-16555
- The further work that is required to make better environmental impact predictions was described by the panel in cross-examination by Commission Counsel. Such work should include: (1) tundra stripping, (2) field experiments on revegetating a high ice content slope, (3) assessment of the route assuming failure of stated policy, (4) impact on birds in the Delta area, (5) field experiments on slide stabilization, (6) continuation of work on frost heave, (7) testing of snow roads on an operating pipeline spread, (8) further investigation of drainage across the frost bulb and (9) assessment of whether the company can meet all the commitments it has made (i.e. unions, aircraft restrictions etc.) Mr. Templeton pointed out that the Cross Delta assessment was deficient in that: (1) it doesn't specify the controls to be placed on personnel and their activities, (2) it doesn't mention native use of the Delta area, (3) there is no assessment of a major oil spill in the Delta and (4) there is no assessment of the effects of a cold pipeline in unfrozen areas. Vol. 109 16674-16689
Vol. 109 16602-16604

b-2 Corridor and Routing

- The Arctic Gas route (prior to the Cross-Delta and Fort Simpson changes) was conditionally acceptable, according to Mr. Templeton in cross-examination by CARC. The over-riding problem is the possibility of gas discoveries along the coastal areas west of the Delta which would lead to a line along the coast anyway. If this wasn't likely, the Board tends to favour the interior route. During cross-examination by the Council for Yukon Indians, the Judge said that the pipeline guidelines contemplate a corridor development so if there were potential discovery areas and possible developments such as a sea terminal and LNG plant on the coast they would affect the corridor decision. Vol. 107
16283-16288
- The routing preferences from an environmental point of view, according to Dr. McTaggart-Cowan are, in order, (1) the Fairbanks route, (2) the Interior route as proposed or modified to go further south, (3) the Coastal route and (4) the Yukon River route. The reasons for this selection were explained by comparing each route's impact on: (1) sheep, (2) caribou, (3) grizzlies, (4) fur bearers, (5) birds, (6) fish and (7) wilderness range. Also assessed in this route comparison were: (1) future discoveries, (2) an oil pipeline and (3) the Dempster highway. Dr. Wilimovsky said that from a purely fisheries viewpoint the coastal route was preferable to the interior route if there was never to be an oil pipeline. The Judge pointed out that this was opposite to the preference of Mr. Walker of DOE (fisheries). In cross-examination by Arctic Gas, Dr. McTaggart-Cowan said preference for the Fairbanks corridor was based on analysis with a Delta supply leg and without. Vol. 108
16288-16305
Vol. 108
16440-16444
16511-16519
16456-16458
16433-16437
- The Board's views on routing were summarized during cross-examination by Arctic Gas as follows: Vol. 108
16522-16532
 - (1) Mr. Gourdeau said he was reluctant to comment from a social impact standpoint because he wasn't a native. From a personal standpoint he thought the interior route had merit if it could avoid Old Crow Flats, (2) Dr. McTaggart-Cowan preferred the interior route, (3) Carson Templeton said he preferred the interior route from a purely Canadian viewpoint but Alaskan impact considerations decreased this preference, (4) Mr. Craik said the most important information required for such a decision is unknown, i.e. the location of future oil and gas discoveries.
- The Cross-Delta and Fort Simpson route changes were not assessed by the EPB according to Mr. Templeton in cross-examination by ITC/COPE. Those two changes affect half the pipeline so, in effect, the present prime route is a new pipeline. Vol. 108
16414-16415
16604-16605
Vol. 107
16315-16317
- The Fort Simpson relocation is in an area of higher ice content than the original route, according to Dr. Adam in cross-examination by CARC. The route as now proposed isn't acceptable. A detailed appraisal considering pulsas and the chilling cut-off point is needed. Vol. 109
16632-16634
- The Cross-Delta route environmental impact statement isn't adequate, according to Mr. Templeton in cross-examination by CARC. The EPB does not approve of that routing. The specific concerns that Dr. Thomson suggested needed investigation are: (1) Shallow Bay and (2) permafrost. Vol. 107
16313-16315
Vol. 109
16596-16600
- A formal motion was presented by the Council for Yukon Indians requesting that the Judge hold community hearings along the Fairbanks Corridor in the Yukon. Commission Counsel suggested that the argument on the Vol. 108
16451-16452
Vol. 109
16726-16736

motion be deferred until March. The Judge agreed.

b-3 Land Use Planning

- The reasons a land use plan is required before a pipeline is approved were explained by Mr. Templeton and the rest of the panel in cross-examination by Commission Counsel. As the plan is developed, judgements would have to be made on government priorities. For example, a corridor type of development should not be allowed in the northern Yukon. A pipeline before a plan would pre-empt the planning process. The selection of a corridor is a fundamental planning function. Things must be thought through ahead of time. The plan would permit pacing of development and preservation of certain parts of the biological environment. The plan does not have to be static. The Arctic Land Use Planning Unit has existed in government for years but it hasn't established the necessary general overview. The Canadian Land Use Inventory could be applied in the north for planning. Certain areas should be set aside for no development and in other areas only limited development-related activities should be permitted - such as pipelines, etc., that go through National Parks. Vol. 108 16555-16575
- The items that need to be considered in developing a land use plan were outlined by Mr. Templeton and Dr. McTaggart-Cowan. They include: native land claims, transportation/pipeline corridors, community expansion, mining and petroleum leases, park areas, potential hydro electric developments, special wildlife areas, IBP sites, etc. In 1972 the EPB recommended to the government that a plan be prepared. No results were forthcoming. Vol. 109 16583-16590

b-4 Snow Roads

- There is no reason to believe that snow roads won't work, according to Dr. Adam in cross-examination by CARC. There is some concern, however, about the reaction of high ice content subsoils (such as exist along the North Slope), amounts of snow, snow harvesting, snow making and the impact of snow fencing. The Judge referred to Commissioner Parker's statement that snow roads are unproven. Dr. Adam pointed out that there is often confusion between snow roads and winter roads. Generally, the proposed snow road technique is viable. If the roads can be built, they can be used. The problem is in building them. Vol. 107 16350-16352
- Historically, snow road construction can start with about 200 degree days, according to Dr. Adam in cross-examination by Foothills. The first mile or so of road would take 5 to 7 days to build, and pipeline work could start as soon as enough snow road was in place. The proposed wheel loadings are twice what has been used previously but test site simulated traffic has demonstrated that this loading is possible. Hauling could start at about 1,000 degree days although there may be problems with river crossings and on peatlands south of Fort Simpson that early. Vol. 108 16480-16491
- Short-term observation and reviews of papers and reports lead to optimism regarding the use of snow roads, according to Dr. Adam in cross-examination by Arctic Gas. They are not operationally proven and perhaps should be on a pipeline spread now operating. Three recommendations for snow roads are: (1) only compacted or ice cap roads should be considered adequate, (2) plans for all roads should be filed one year prior to use and (3) there must be adequate inspection and enforcement of regulations. Vol. 108 16496-16499

b-5 Terrain

- Thaw settlement is of environmental concern because it leads to drainage disruption and erosion, according to Dr. Adam in cross-examination by Arctic Gas. A "major" impact would be when more than 5% of the route (on a regional basis) had depressions greater than two feet. This was a subjective judgement. Vol. 108 16499-16506
- The main terrain concerns, according to Dr. Adam in cross-examination by Commission Counsel, are: Vol. 109 16634-16648
 - (1) changes in aquatic habitat, (2) changes in wild-life habitat, (3) aesthetics and (4) project integrity.
 Also of concern, according to the panel, are:
 - (1) siltation, (2) sequential developments, (3) stabilization of ice-rich slopes, (4) continued re-entry and (5) the overall aesthetic consequences of the project and the pattern this project would set for subsequent events.

b-6 Revegetation

- The difference between the two applicants in their use of (a) native species and natural landraces (Foothills) and (b) agronomics with native species (Arctic Gas) results from the different requirements of each project and the background of the consultants, according to Dr. Bliss in cross-examination by Arctic Gas. Arctic Gas has extensive portions in the tundra where agronomics give the rapid plant cover that cannot be provided by native species. Vol. 108 16506-16508

b-7 Wilderness

- The bulk of the North Slope should be preserved as wilderness, according to Dr. Bliss in cross-examination by Commission Counsel. The Judge noted that pipeline guideline #4 makes provision for setting aside areas and described the areas that have been suggested before the Inquiry as warranting such attention. Dr. McTaggart-Cowan said there was no trade-off for the North Slope and that is the reason the Canadian Arctic Wildlife Range is so important. The problem is that there is no land use plan to control activity. Vol. 109 16648-16674
- The panel agreed with the Judge's statement that wilderness has a higher order of value than the (money) market recognizes, and noted that it is almost impossible to quantify wilderness values. Vol. 109 16714-16717

b-8 Game Management

- The Arctic Gas approach to such things as the effect of flights on wildlife are "rough cut tests" which should be adequate to design mitigative measures, according to Dr. McTaggart-Cowan in cross-examination by CARC. Vol. 107 16335-16339
- The figures on game and fish harvesting in the N.W.T. as reported in an *Environmental-Social Program report should be considered as very minimum figures and shouldn't be regarded as representative of actual use, according to Mr. Gourdeau in cross-examination by the N.W.T. Indian Brotherhood/Métis Association. Even these minimum figures show that resource use is significant. There is no indication of an absolute decrease in people's dependence on the land, but due to the increasing population and southern influence the use has changed in degree only. Vol. 108 16415-16419

* Regional Impact of a Northern Gas Pipeline, Vol. 5.

- Native peoples have a recognized knowledge of biology and game management, according to Mr. Gourdeau in cross-examination by the CYI. Native people have been successfully involved in game management in the Fort Chimo area and in the management of the reindeer herds. Vol. 108
16458-16460
- Game management planning is a joint responsibility of the public and the proponents of development, according to Dr. McTaggart-Cowan in cross-examination by Commission Counsel. All forms of hunting except for resident trappers, should be banned for two miles on each side of the pipeline right-of-way and along all roads. The government will be in a position to formulate a game management plan only with extensive information. The pipeline decision will have to be based on available information. Vol. 109
16618-16621

b-9 Caribou

- The difference in coastal and interior route preferences among the caribou experts is a legitimate difference of professional opinion, according to Dr. McTaggart-Cowan in cross-examination by ITC/COPE. More information is required on live births and live calves-at-heel so that yearling input/animal kill relationships can be better understood. The real issue in controlling impact is to avoid disturbance of the animals wherever they are. The EPB over-flight restriction of 2,000 feet would be better than the 1,000 feet proposed by Arctic Gas. Vol. 107
16401-16406
- The Fairbanks corridor is preferred from a caribou zoologist's standpoint, according to Dr. McTaggart-Cowan in cross-examination by the CYI. The caribou herd could seriously decrease in 10 to 15 years if not carefully handled. Historically, herds decrease slowly over a large number of years, then collapse rapidly. There is insufficient backup data to make predictions. The Dempster Highway is of concern and tends to counter the preference for the interior route over the coastal route. The interior route is the lesser of two evils. Vol. 108
16420-16432
- Since society makes the decision to build the pipeline through politicians, it must take some responsibility in managing resources (such as the caribou) and not expect the proponent to bear the entire responsibility, according to Dr. McTaggart-Cowan in cross-examination by the CYI. If damage is traceable to the pipeline, the cost of restoration is clearly the pipeline company's responsibility. Vol. 108
16444-16451
- The Porcupine herd has had a history of contact with man through native hunting, whalers and the DEW line, according to Dr. McTaggart-Cowan in cross-examination by Arctic Gas. The pipeline landing strips should be off limits to the general public, however, to minimize impact. Vol. 108
16519-16522

b-10 Birds

- The applicants have not proposed any effective means of controlling access to protect birds, etc., according to Dr. McTaggart-Cowan in cross-examination by Commission Counsel. The Canadian Wildlife Service is performing that function now. A game management plan would be the start of effective controls. Vol. 109
16615-16618

b-11 Fish

- More work is required on methanol disposal to ascertain: (1) fish tolerance, (2) disposal effects by time of year, according to Dr. Wilimovsky in cross-examination by CARC. Vol. 107
16331-16332
- Fishing by pipeline personnel should be permitted and used as a means of getting fisheries data such as catch per unit effort, according to Dr. Wilimovsky in cross-examination by CARC. Control can be exercised by the government and the applicant. The proportion of people who would fish would probably be limited to those who would fish anyway. Control would have to be exercised in areas of domestic fisheries. Vol. 107
16332-16335
16369-16376
- The four factors that require attention in data gathering to develop a fish management plan are: (1) fish recruits, (2) fish growth, (3) natural death, and (4) harvest by man, according to Dr. Wilimovsky in cross-examination by Commission Counsel. The resource is managed for the benefit of man not the resource, and the type of management depends on whether the goal is to provide for sport, domestic or commercial fisheries. All levels of government should co-operate in establishing water quality standards. Vol. 109
16695-16701
- There are very few places in North America that have a complete fisheries inventory but, in this case, more work should be done in stock size and vulnerability, according to Dr. Wilimovsky in answer to the Judge's question. In cross-examination by Commission Counsel and CARC Dr. Wilimovsky said that environmental standards relating to fisheries (i.e. siltation) should be established. Vol. 107
16329-16331
Vol. 109
16689-16695

b-12 Blasting

- The three factors which influence fish mortality due to blasting, according to Dr. Wilimovsky in cross-examination by Foothills, are: (1) air bladder of the organism, (2) the peak pressure of the explosion, (3) the integration of pressure over time and (4) the shape of the pressure wave. Blasting under ice can increase mortality by 20 to 25%. Vol. 108
16463-16466

b-13 Aircraft Flights

- The EPB Code (section 14.6) should be amended to limit aircraft flights to a minimum of 2,000 feet in all cases where caribou are present, according to Dr. McTaggart-Cowan in cross-examination by the CYI and Arctic Gas. Over-flights should be prohibited during periods of caribou aggregation. Vol. 108
16455-16456
16510-16511
- Flight corridors should be as narrow as possible to reduce overall impacts, according to Dr. McTaggart-Cowan in cross-examination by Commission Counsel. Areas of particular concern are north of Norman Wells, the crossing of the Mackenzie and the Delta. Mr. Craik said that more study is required but it requires more effort than the applicants are able to mount. It is a responsibility of government. Vol. 109
16611-16615
Vol. 109
16600-16602

b-14 Regulatory Agency

- The government and the applicant each have a responsibility, and the Code outlines the type of government structure necessary to make sure that the applicant lives up to its obligations, according to Mr. Templeton in cross-examination by CARC. Mr. Craik said there is a tendency to under-rate the planning required to lead up to a project. It is a Federal Vol. 107
16317-16322

Government responsibility. The agency should be a single authority reporting through one Minister with powers and flexibility similar to the NEB or a Crown corporation. It should be ready for pre-construction, construction and post-construction activities after which the responsibilities would revert to the various governments.

- The applicant hasn't transferred its knowledge into environmental protection measures, according to Mr. Templeton in cross-examination by CARC. There is a general lack of synthesis. The work needs to be put into a form that a contractor/engineer can understand. The environmental and social dimensions disrupt the highly optimized method of pipeline construction. The contractor would have to be held accountable by a bond. Vol. 107
16322-16327
- There should be a front-end charge to pay to rectify damages during construction, according to Dr. McTaggart-Cowan in cross-examination by the CYI. After construction the costs for abandonment would be taken into account by the regulatory agency (NEB). Vol. 108
16452-16455
- There is still time to establish a single regulatory agency but it is possible to recommend a time lag so the government force can meet the decision dates, according to Mr. Templeton in answer to the Judge's questions. There is also need for a public auditor group. The work of the Alaskan auditor group established under the Arctic Institute of North America was explained by Dr. Wilimovsky. Referring to the regulatory agency, Mr. Craik pointed out that the problem is one of organization, not legislation. The problem is the diversification of responsibility. Vol. 107
16378-16388
- The problems associated with an agency shut-down of the project would have to be resolved by the applicant and the agency, according to Mr. Templeton in cross-examination by Foothills. The agency would have to deal with minor and major route changes. In the latter case, a 180 day response period is recommended as described in the Code. Vol. 108
16474-16476
Vol. 108
16478-16479

b-15 Environmental Auditor Group

- The independent environmental auditor group would have no line function, according to Mr. Templeton in cross-examination by Foothills. It would report directly to the public. Vol. 108
16477-16478
- An outline of the environmental auditor group was given by Dr. Wilimovsky in cross-examination by Commission Counsel under the headings; implementation, purpose, membership, operations and staff, reporting, budget, authority and power, time-frame and termination. Mr. Templeton stressed that it would not be similar to the Alaskan group. The group should have 7 to 11 members. Vol. 109
16590-16596
Vol. 108
16575-16582

b-16 Environmental Training and Inspection

- The qualifications of the project environmental inspectors for the pipeline company and the agency would be similar but their roles would be quite different, according to Mr. Templeton in cross-examination by Foothills. The company inspection people should report to the project manager because he has the necessary authority. Backup would be provided by head office. The training of workers on environmental and social matters will be like setting up a major school district. It takes time. The EPB has issued a report on this outlining the general strategy. Vol. 108
16476-16477
Vol. 108
16470-16473
Vol. 108
16466-16470

- The applicants have not made the necessary training commitments, according to Mr. Templeton in cross-examination by Commission Counsel. Mr. Gourdeau suggested that an outside organization like Frontier College could be used. It would make native participation easier. Vol. 109
16605-16611

b-17 Code

- The finalized environmental code would outline the general performance expected, according to Mr. Templeton in cross-examination by Foothills. The pipeline company would have to submit plans (including contingency plans) for each section. The agency would have 180 days to respond. Then the pipeline company would submit detailed plans for approval. Vol. 108
16480
- The EPB Code is a performance code and should be read literally for this project, according to Mr. Templeton in cross-examination by Commission Counsel. The regulatory agency should be left with decision-making authority. Vol. 109
16701-16708
16710-16713

b-18 Termination of the EPB

- The termination of the Environmental Protection Board was announced by Mr. Templeton in a prepared statement read to the Inquiry at the end of the Board's evidence and cross-examination. Vol. 109
16717-16725

b-19 Miscellaneous

- Papers presented at the CARC conference in December dealing with Delta development were filed as exhibits. Vol. 107
16281-16282
- Terrain susceptibility maps requested during Mr. Zoltai's appearance were filed as exhibits. Vol. 107
16282

C. Socio-Economicc-1 Land Claims

- Pipeline construction prior to a land claims settlement would definitely prejudice the settlement, according to Mr. Gourdeau in cross-examination by the N.W.T. Indian Brotherhood/Métis Association. The James Bay experience is proof of this. Vol. 108
16419-16420

D. Miscellaneous

- CARC announced that Dr. Pimlott had been made Director of the Northern Assessment Group and Mr. Garth Evans had been retained to assist counsel.

E. Inquiry ScheduleMarch

- 1 - 12 Community hearings in Tuktoyaktuk, Sachs, Holman and Paulatuk.
- 15 - 26 Formal hearings in Yellowknife.

April

- 5 - 15 Formal hearings in Yellowknife.
- 26 - 30 Formal hearings in Yellowknife.

E. Inquiry Schedule (cont'd)May

- 3 - 12 Formal hearings in Yellowknife
- 12 - 31 Community hearings in Southern Canada:
Vancouver, Edmonton, Calgary, Regina,
Winnipeg, Toronto, Ottawa and Montreal.

June

- 1 - 5 Community hearings in Southern Canada:
Vancouver, Edmonton, Calgary, Regina, Winnipeg,
Toronto, Ottawa and Montreal.
- 14 - 18 Formal hearings in Yellowknife
- 18 - not yet determined.

Policy and Planning (ACND)
Division.
February 13, 1976.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 79 TO 86)

Arctic Gas: Air, Water and
Terrain Evidence

YELLOWKNIFE, N.W.T.

OCTOBER 23, NOVEMBER 3 TO 8
AND NOVEMBER 12 AND 13, 1975

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TOPIC: Phase II: The Impact of a Pipeline and Mackenzie Corridor Development on the Physical Environment.

Terrain, Water Resources, Air Quality.

DATE: October 23, November 3 to 8 and November 12 and 13, 1975 in Yellowknife.

WITNESSES: Arctic Gas' Phase II panel consisting of:

- Mr. R.A. Hemstock: Director, Environmental Studies, Imperial Oil Ltd. (on loan to Arctic Gas).
- Dr. J.I. Clark: Supervisor, Geotechnical and Environmental Studies, NES.
- Mr. D.L. Dabbs: Manager, Environmental Division, R.N. Hardy and Associates Ltd.
- Mr. R.L. Harlan: Manager, Special Studies, NES (on loan from R.M. Hardy).
- Dr. P.J. McCart: President, Aquatic Environments Ltd. and Assistant Professor, Department of Biology, University of Calgary.
- Ms. G.V. Minning: Senior Staff Geologist, NES.
- Mr. G.L. Williams: Director, Field Services, NES (seconded from Williams Brothers Canada Ltd.)
- Mr. C.M. Koskimaki: Senior Engineer, NES.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Engineering/Technical

- nil

B. Environmental

b-1 Land Use

- The land required for permanent and temporary pipeline facilities would be 42.5 square miles, according to Mr. Hemstock. In response to cross-examination by the NWT Indian Brotherhood/Métis Association, Mr. Hemstock said this did not include requirements for indirect activities or looping. He agreed it is not a very useful figure for impact assessment. Areas of critical significance should be identified. Vol. 78
11614-11615
Vol. 80
11848-11851
Vol. 81
12016-12018
- The pipeline right-of-way would act as a barrier for other land use activities because special permission would have to be obtained for access, according to Commission Counsel in cross-examination of Mr. Hemstock. Arctic Gas pointed out that the NEB and Arctic Gas would regulate the use of the right-of-way by others to protect the integrity of the pipeline. Vol. 82
12223-12235
12245-12257

b-2 Terrain - General ImpactTRANSCRIPT
REFERENCE

- A general description of the impact of construction and operation of the pipeline was given by Ms. Minning. Vol. 78
In cross-examination by Commission Counsel, 11611-11614
Mr. Hemstock agreed that the general principles 11620-11623
which govern such impacts are: (1) lakes, 11656-11658
streams and the associated valleys deserve Vol. 85
special consideration, (2) water bodies should 12708-12711
not, as a general principle, be disturbed, (3)
Changes should be minimized to such features
as: shores, banks and flow of water bodies;
visual aesthetics; wilderness; fish and aquatic
ecosystems; animal habitats, etc., (4) Integrity
of the environment should be assured during re-
entry for operation and maintenance.

b-3 Route

- The only two route changes seriously being considered are at Great Bear River and at Rapid Creek although some other minor changes are under discussion, according to Mr. Williams and Dr. Clark in cross-examination by Foothills. Vol. 80
11828-11839
11886-11889
- The total environmental impact of the prime route would be less than the Fairbanks route, according to Mr. Hemstock in cross-examination by CARC. Vol. 80
11851-11863
Since there was no difficulty in a route down the valley there is no need to recommend an environmental study of the East of Franklins route even though it appears to have better terrain. The valley is already disturbed while the Franklins area is wilderness. The pipeline route is chosen on the basis of engineering and financial considerations after which environmental people are asked to comment.
- The borrow site locations had little influence on the route selection, according to Mr. Williams in cross-examination by ITC/COPE. Vol. 81
12078-12083
- Access would be easier for the coastal than the interior route, according to Mr. Williams in cross-examination by the Council for Yukon Indians (CYI). Route changes would also be easier to accommodate on the coastal route. The use of permanent access roads off the Dempster Highway, if the Interior route were used, would be up to the government's regulatory authorities. Vol. 82
12176-12177
12173
- The Cross-Delta route is now the prime route according to counsel for Arctic Gas. Environmental studies relating to that route will be available in January for that phase of the hearings, according to Mr. Hemstock in cross-examination by CARC. Vol. 82
12185
12204-12205
- The Cross-Delta route is now the prime route according to counsel for Arctic Gas. Environmental studies relating to that route will be available in January for that phase of the hearings, according to Mr. Hemstock in cross-examination by CARC. Vol. 83
12331
12383-12385
Vol. 80
11867-11869
- The Fort Simpson route change environmental studies available prior to Arctic Gas approval of the change were requested by CARC. Mr. Hemstock explained that the reason for the change was to avoid the Liard River. The environmental impact for the two routes is not likely to be different. Commission Counsel was told that the environmental information would be produced at the same time as the Cross-Delta route change information (early 1976). Vol. 80
11863-11867
- The oil pipeline impact assessment, as required by the pipeline guidelines, must be given by the applicants for a gas pipeline, according to the Judge. He asked that the applicants advise when this would be done. Vol. 83
12406
- The oil pipeline impact assessment, as required by the pipeline guidelines, must be given by the applicants for a gas pipeline, according to the Judge. He asked that the applicants advise when this would be done. Vol. 83
12518-12522

TRANSCRIPT
REFERENCE

b-4 Environmental Input

- The unique involvement of environmental experts in the planning of the project was pointed out by Commission Counsel who then asked if any witness had environmental reservations about the project as proposed. None did. Mr. Hemstock then agreed to eight principles of environmental planning suggested by Commission Counsel: (1) Land should not be unnecessarily disturbed, (2) Visual and aesthetic values should be maintained, (3) Wilderness areas should be protected, (4) Disturbance to the ground surface should be minimized, (5) Resources in short supply should be conserved, (6) Land use conflicts should be avoided, (7) Archaeological, historical and environmental sites should be protected (or salvaged) and (8) Where disturbance does occur stabilization and restoration steps should be taken.

Vol. 82
12207-12222

b-5 Clearing

- Hand clearing would be done in the summer and fall with machine clearing done in the late winter when the roots are frozen into the ground, according to Mr. Williams in cross-examination by CARC. Slash and debris would be burned.

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b-6 Snow Roads

- Snow roads would protect the terrain to the satisfaction of environmentalists according to Mr. Hemstock in cross-examination by CARC. Manufacturing of snow would be preferred over harvesting although, according to Dr. McCart, there would be little problem of harvesting from shallow water areas of lakes less than four feet deep. The existing Land Use Regulations which require eight inches of frost for a snow road are adequate to protect the terrain, according to Mr. Hemstock. The maximum road grade for vegetation protection would be near 16 per cent parallel to the road or 11 per cent on side slopes. The maximum vehicle ground pressure would be from 80 to 100 psi as opposed to the EPB recommendation of 8 psi.

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b-7 Borrow Pits and Requirements

b-7-1 General

- The borrow requirements for the project as outlined by Ms. Minning, would lead to a total requirement of 30 million cubic yards from 98 sites. This does not include backfill and concrete aggregate requirements. Mr. Hemstock said that the Delta Producers would require an additional 2.5 to 3 million cubic yards. The preferred borrow sites and quantities required along various routes were described. Typical borrow site development plans were illustrated. The granular requirements would be about two-thirds again as much if the surcharge berm was 10 feet high, as may be anticipated if Mr. Williams' frost heave theory is correct, according to Dr. Clark in cross-examination by ITC/COPE. The original

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b-7-1 General (Cont'd)TRANSCRIPT
REFERENCE

estimate does have a 20 per cent contingency for unforeseen circumstances. A breakdown of the borrow requirements by class of material was supplied to DIAND for their inventory. The pits which are on Commissioner's Land have been identified although no contact has been made with the communities to see what royalties they would charge.

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b-7-2 Impact

- The potential undesirable impacts of borrow pit development, as outlined by Commission Counsel and agreed to by Mr. Hemstock, are: (1) use of a resource in short supply, (2) pre-emption of land and land use conflicts, (3) visual disturbance, (4) terrain, vegetation and drainage disruption, (5) disturbance of aquatic habitats, (6) disturbance of mammal and bird habitats, (7) noise disturbance to animals, birds, and people. The competing uses for potential borrow pit sites were also outlined. Environmentalists have input on borrow pit work from the start but their role is largely reactive. Arctic Gas is looking at an environmental rating of pits similar to that suggested in the PAAG report, according to Ms. Minning. Vol. 83
12348-12355
- The Thunder River compressor station and ancillary facilities were selected by Commission Counsel to ascertain from Mr. Williams and Ms. Minning what the applicant's plans mean. The proposed work was typified as a mini industrial development with a compressor station, 6,000 ft. of airstrip, 7 miles of permanent road, a wharf, a material stockpile site and a communications tower. The development would require more than 2 million cubic yards of gravel of a quality that is not yet specified. The witnesses agreed that the borrow specifications for the various facilities would be adjusted to suit the resources available and the stipulations of the regulatory agency. Arctic Gas would not take prime quality material if they could do without, thus assuring future users adequate borrow materials wherever possible. Mr. Hemstock pointed out that insulation could be used to decrease the borrow requirements and some gravel could be salvaged following abandonment. Mr. Williams said that low quality material could be used as the core with only the capping of higher quality borrow. Details of the development of the Thunder River area and others like it have not been worked out. Vol. 83
12372-12383
- The environmental input for the development of the borrow pit in a sensitive area of the Rat River was described by Mr. Hemstock for Commission Counsel. In effect, an environmental impact type of assessment would be done for each quarry. Vol. 83
12385-12389
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b-7-3 Pit Selection

- The process of borrow pit selection, according to Ms. Minning in cross-examination by CARC, is: (1) select sites with good material, (2) investigate (3) submit a development plan in accordance with DIAND requirements. Site specific environmental comments would be made in preparation of the development plan, according to Dr. McCart. From a fisheries viewpoint upland sites are better than flood plain sites. Mr. Hemstock pointed out there were other considerations which could make a flood plain site superior, such as the presence of denning sites in upland areas. Vol. 80
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b-7-3 Pit Selection (Cont'd)TRANSCRIPT
REFERENCE

- The permanent access roads that would be used for borrow pits are shown on the strip maps, according to Ms. Minning in cross-examination by CARC and ITC/COPE. Vol. 80
11907
- More borrow material would be required on the interior route than on the coastal route, according to Mr. Williams in cross-examination by the CYI. Ms. Minning explained that most of the interior route granular material would come from bedrock areas. Vol. 81
12066-12067
- Spits and bars along the North Slope would not be used as borrow sources, according to Mr. Williams in cross-examination by CARC. At the Shingle Point site cited, the source would be in a bank behind the beach. Vol. 82
12164-12171
- The proposed borrow site near Fort Good Hope is locally known as Old Baldy and is a valued recreation area, according to the NWT Indian Brotherhood/Métis Association in cross-examination of Ms. Minning. Vol. 82
12203-12204
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12018-12021

b-7-4 Active Flood Plains

- The Alyeska project favoured the use of active flood plain borrow sites over upland sites for aesthetic reasons and mammal habitat preservation, according to Ms. Minning in cross-examination by ITC/COPE. Active flood plain sites also renew themselves. The main concerns with use of flood plains are: (1) fish habitat loss, (2) trapping of fish and (3) siltation. The use of such sites would be confined to the North Slope rivers as outlined by Dr. McCart. A buffer zone would be left between the active river channel and the pit and berms would be placed around the pit. Vol. 81
12092-12095
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12581-12584
- Borrow operations could be right up to the edge of the active channel if there were no environmental objections, according to Ms. Minning in cross-examination by CARC. Mr. Williams pointed out that buffer zones would be left. After use the borrow area would be levelled to prevent ponding and trapping of fish. Equipment would be brought to the borrow area over snow roads, the winter before construction, with gravel mining taking place in the late summer prior to construction. The gravel would be windrowed for winter extraction. If water entered the pits it would become a problem at depths greater than three feet. Mr. Harland said if this happened he would not recommend that it be pumped out. Vol. 81
12114-12134
- The schedule of spread C (on the North Slope) was reviewed by Commission Counsel with Mr. Williams to clarify the flood plain borrow plans. It was agreed that the key pit considerations were its aerial extent and depth. Gravel would not be taken from stream beds with flowing water and buffer zones would be left. Due to the fluctuations in an active river channel, Commission Counsel questioned how Arctic Gas could assure it would not take material from an area of flowing water. It was agreed that gravel might be taken from areas where there was a seasonal flow of water. The important thing is to avoid affecting the fish and sedimentation at the time of the operation. Vol. 80
11891-11901
- Vol. 84
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b-7-4 Active Flood Plains (Cont'd)TRANSCRIPT
REFERENCE

The panel said they could not use the North Slope flood plain sources and comply with the DOE guideline used for borrow operations on the Mackenzie Highway. It was suggested that these guidelines were inappropriate for North Slope braided streams. Commission Counsel suggested that the types of information which should be provided with a flood plain pit development plan are: (1) proximity of fish, (2) times of fish movement past the area, (3) the size and significance of the fish population, (4) human use of the fish resource, (5) proximity of bird breeding and staging areas, (6) mammal range locations, (7) the valley cross-section, (8) the normal flow regime, (9) the potential for icing, (10) bed load and sediment transport. Dr. McCart indicated that the last item would be very difficult to obtain and of little use since it would have no quantitative relationship to fish.

- The handling of water which seeps into the active flood plain borrow pits and the effect on siltation of the stream were explored by Commission Counsel. Ms. Minning said that all pits would be restored after construction and before the spring run-off. Mr. Williams said that the pit development plan will contain sufficient information to enable the regulatory agency to evaluate the decision on quantities to be removed from the pit. The monitoring period and release of a pit after development is a decision for the government agency, according to Mr. Hemstock.

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b-7-5 Pit Development Plan

- Borrow pit development considerations include flow diversion, stilling basins, slope stabilization, re-contouring and re-vegetation, according to the panel in cross-examination by CARC. A development plan for each site which would include restoration plans would be submitted for approval. DIAND has not yet specified what would be required in such plans.
- The site development plans would be used for: (1) the permit application, (2) reviewing with concerned people and (3) planning and (4) contractors, according to Ms. Minning in cross-examination by Commission Counsel. Feedback from the government on their requirements would be appreciated. The plans will show: (1) details of the source, its thickness, quantity and quality, (2) the permafrost, water table and ice content, (3) machinery to be used and schedule, (4) stilling basins and other special drainage measures, (5) the final form of the pit and rehabilitation techniques including revegetation and spoil disposal, (6) follow-up monitoring plans, (7) an environmental impact statement and (8) use of the site as a sanitary land fill area if planned.

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TRANSCRIPT
REFERENCE

b-7-6 Borrow Allocation

- The problem of local shortages and use by the frost development which would place subsequent users in an adverse position for granular resources, was discussed by Ms. Minning in cross-examination by ITC/COPE and CARC. DIAND is assessing this problem on a segment-by-segment basis of highway, oil and gas pipeline, looping and railroad developments. An oil pipeline would require about 40 million cubic yards. One problem area would be from MP 0 to 172. Lower quality materials might have to be used with special additives to make soil cement or asphalt might have to be added. Community consultation on granular resource allocation is planned. Mr. Hemstock said a committee has been formed with the Delta Producers to deal with problems such as granular resource allocation. In general, as few pits as possible will be opened.

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12032-12047
12053-12058
- The government granular materials inventory covers the area from Richards Island to Fort Simpson and outlines material type and volumes, according to Ms. Minning in cross-examination by Commission Counsel. Ms. Minning outlined the areas of potential shortage. If necessary, lower grade materials could be used as was done on the northern part of the Mackenzie Highway. Even with material substitution the Simpson area and MP 0 to 172 would always have a shortage of granular materials. The cross Delta route would place additional demand on the limited resources on the east side of the Delta.

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b-8 Revegetation

b-8-1 Agronomic and Native Varieties

- Native grass varieties would be mixed with the faster growing agronomics to provide quick initial erosion control, according to Mr. Dabbs in cross-examination by Foothills. This decision was reached after field tests in the Inuvik area and elsewhere. Native varieties would provide the long-term growth. Foothills suggested that reports show that native varieties perform as well as agronomics in the first year. The dead ground cover produced by agronomics would not impede the re-establishment of native varieties and would not produce a fire hazard, according to Mr. Dabbs. Foothills questioned the success rate of certain varieties and Mr. Dabbs pointed out that seed mixes were designed so that each variety would fill a different niche to obtain an adequate overall success rate.

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- The agronomics are closely related to the native flora and the "rabbit to Australia" syndrome is not substantiated in this application, according to Mr. Dabbs in answer to the Judge's questions.

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b-8-2 SeedTRANSCRIPT
REFERENCE

- Seed for native varieties is collected from plots in the Delta and from areas in Northern Alberta, according to Mr. Dabbs in cross-examination by Foothills. Mr. Dabbs said it is reasonable to expect that seed can be produced in sufficient quantities for the pipeline project. In four years, a million pounds of seed will be available. Three seed mixes are proposed (as were outlined in an appendix to the evidence in-chief). These are applied on the basis of erodability which is a function of soil condition, temperature, slope, drainage, etc...

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- The erodability criteria was developed from the previous Canada Agriculture standard which cued seed combinations to soil drainage criteria, according to Commission Counsel in cross-examination of Mr. Dabbs. The erodability criteria incorporates the old drainage criteria but cues the combination to erodability which is developed by geotechnical engineers. This brings the biological and engineering work together. Other variations may appear in the final design stage. The seed mix specifications provided are primarily for mineral soils.

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 12292-12306

b-8-3 Revegetation Techniques

- Revegetation techniques were described by Mr. Dabbs with the aid of slides. Reseeding is now recommended as a winter operation to follow clean-up. This will give closer control in the placement of different seed mixes.

Vol. 79
 11711-11731
- The variety of seed used in different circumstances was addressed by Foothills in their cross-examination of Mr. Dabbs. The objective of reseeded is to achieve a 50 to 60 per cent ground cover in an area of medium erodability.

Vol. 80
 11779-11782
 11791-11799
- A revised table entitled: "Pipeline Revegetation Specifications for Areas North of 60° Based on Regional Climate and Potential Erodability" was submitted by Mr. Dabbs to correct errors in the previous table and to update the material contained in the application.

Vol. 81
 11958-11961
- The use of shrub cuttings to stabilize slopes was described by Mr. Dabbs in cross-examination by Foothills.

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 11770-11771
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- The first objective of revegetation is to prevent physical and thermal erosion, and revegetation along with a chilled pipeline will restore the permafrost to a pre-pipeline condition, according to Mr. Dabbs in cross-examination by CARC. Some shrubs and trees will be allowed to re-establish on the right-of-way. No herbicides will be used north of 60°. Aerial seeding will be scheduled to avoid conflicts with bird and caribou movements. The caribou grazing effect on the revegetated areas was studied at Sans Sault and Prudhoe Bay.

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b-8-3 Revegetation Techniques (Cont'd)TRANSCRIPT
REFERENCE

- The seeding would be a winter operation with a spring dressing which would be timed to avoid conflicts with the living environment according to Mr. Dabbs in cross-examination by ITC/COPE. Aerial reseeded would be done with aircraft at about 100 feet. The addition of the seed/fertilizer mix to water bodies wouldn't pose much of a problem, according to Dr. McCart. If reseeded areas are cropped by wildlife they can recover naturally. Vol. 82
12137-12155
- Sod replacement procedures would be used in tundra areas, according to Mr. Dabbs in cross-examination by Foothills. In Commission Counsel's cross-examination, Mr. Dabbs said the Tuk tests are aimed at evaluating where this procedure could be used. Problems were encountered in removing the vegetative mat. The idea is still in the feasibility assessment stage. Vol. 79
11744-11751
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12315-12321
- The interior route would cause greater disturbance to vegetation than the coastal route, according to Mr. Dabbs and Mr. Williams in cross-examination by the CYI. The cost of reseeded would be greatest on the interior route but the revegetation would probably be quicker on the interior route. Generally revegetation can occur in as short a period as two months but to account for weather, etc., the program is not guaranteed for four or five years. Vol. 82
12163-12164
12171-12176
- The revegetation tests were a best possible simulation of what is proposed by Arctic Gas but did not account for unusual conditions such as severe cracking of the soil over the pipeline, according to Commission Counsel in cross-examination of Mr. Dabbs. Such cracking could occur if a compressor station failed allowing hot gas through the line. Mr. Dabbs said that a successful revegetation program depends on a physically stable condition. Ground under winter roads is unlikely to be compacted when it thaws but if it were, it may be necessary to break up the surface with a ripper prior to revegetating. Vol. 82
12306-12315
- Commission Counsel asked Mr. Dabbs how he would revegetate a slope such as that at the Kotanelee River on the Pointed Mountain line. Noting that no slope on the Arctic Gas route is like that, Mr. Dabbs emphasized the need for engineers to provide a physically stable situation for revegetation. Surface water should be redirected at the top of the hill and long and high dikes provided. Shrub cuttings should be planted and the entire right-of-way reseeded in accordance with the Arctic Gas specifications. Vol. 82
12322-12327
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12331-12335

b-9 Slopes

- Slopes less than three degrees may be considered stable although it is a function of soil type, drainage, climate, etc., according to Dr. Clark in cross-examination by Foothills. Unstable slopes may require special stabilization techniques such as special revegetation or gravel fill as proposed by Dr. Morgenstern for the Great Bear River crossing. Vol. 80
11799-11807

b-10 Drainage and IcingsTRANSCRIPT
REFERENCE

- Winter construction has both economic and environmental advantages, according to evidence read by Ms. Minning dealing with the hydrological considerations in route location and refinement. The pipeline related effects on surface and subsurface drainage were described and Mr. Harlan used slides to illustrate various types of icings. Vol. 78
11653-11655
- The erosive capacity of the surface flow must be known to determine the site specific intervals for mound breaks, according to Dr. Clark and Mr. Harlan in cross-examination by Foothills. No empirical data is available on the use of subsurface drains to maintain flow. The concept is based only on theory. Vol. 78
11625-11629
Vol. 79
11732-11792
- Ponding and icing concerns increase in ground water spring areas such as along the North Slope and along the Franklin Mountains, according to Mr. Hemstock and Dr. Clark in cross-examination by CARC. If such areas caused problems that mitigating measures couldn't solve, the line would be rerouted. Mr. Harlan pointed out that the object is to maintain natural drainage. Mound breaks are to be used. CARC suggested that horsetail drainage areas could pose a problem. Subsurface drainage would be maintained by use of insulated pipes through the frost bulb or by insulating the pipeline itself. The installation of the insulated pipe was explained by Mr. Williams. Mr. Harlan said that a drilling program is planned for this spring to study subsurface aquifers. Vol. 81
11971-11988

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b-11 River Crossings

- The requirement on the Mackenzie Highway that all creeks or rivers crossed with a drainage area greater than one square mile need a site specific design would not be meaningful for the pipeline, according to Dr. McCart and Mr. Harlan in cross-examination by Commission Counsel. Using the PAAG response concerning the Blackwater River crossing as an example, Commission Counsel tried to determine the basis upon which the applicant decided a design was necessary. Mr. Harlan said information would be provided for all crossings except where significant flow, scour and lateral migration are not anticipated. Preliminary designs are done for 36 crossings. Mr. Hemstock suggested that the presence of fish downstream would be one criteria for detailed assessment of a crossing. Mr. Harlan said that about 150 river crossings north of 60° would be subject to individual design. The criteria used would be primarily engineering although all would be reviewed by environmentalists. The information provided on the designs would depend on the requirements of agencies such as the Territorial Water Board. Vol. 85
12711-12730

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12798-12801
- Where ice bridges are used the Land Use Regulation requirements would be followed, according to Mr. Hemstock in cross-examination by CARC. Mr. Hemstock suggested that the EPB design formula for ice bridges is, at best, an indicator and undertook to supply CARC with his own paper on that subject. Vol. 86
12802-12807

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12549-12552

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b-11 River Crossings (Cont'd)TRANSCRIPT
REFERENCE

- Fish studies on rivers (mainly the Malcom and Firth) crossed by the pipeline and as overwintering areas were explained by Dr. McCart in cross-examination by ITC/COPE. In general, Dr. McCart said, construction would have little effect on the fish. Mr. Williams said trenching methods could be altered to minimize impact if that were necessary. Overhead crossings are possible but not desirable.

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12632-12653
12655-12658

b-12 Siltation

- The increase in silt loads carried by rivers as a result of construction activity and after construction was addressed by all participants. In cross-examination by Commission Counsel. Dr. McCart pointed out that the natural sediment loads are greater than any that would result from pipeline construction. The concern is when the sedimentation occurs. There are ways to control this such as stilling basins, sand bag dikes, etc., but once the sediment has entered the stream not much can be done. The streams are generally rehabilitated by the first spring fresher which acts as a natural cleanser before fish spawning. Dr. McCart disputed the usefulness of siltation standards as a means of assessing impact.
- The use of flood plains for gravel operations may be done in places without harm as is being done in Alaska, according to Dr. McCart in cross-examination by CARC. Siltation where there is spawning is a concern but examination of the Montreal to Sarnia pipeline indicates that mitigative measures are successful. Where washing of granular material is necessary for concrete aggregate, stilling ponds will be used to avoid water course siltation.
- Sedimentation that might continue past flood periods because of channel instability caused by pipeline operations would not be as great a concern as the EPB suggests, according to Mr. Harlan and Dr. McCart in cross-examination by ITC/COPE.
- Spoil from operations on the right-of-way and in particular at cuts on approaches to river crossings would be disposed of along the right-of-way or hauled away to a disposal area such as a borrow pit, according to Mr. Williams in cross-examination by Commission Counsel and CARC. Measures would be taken to control run-off sedimentation of water bodies.

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12552-12556

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12525-12532

b-13 Water Use

- Evidence in chief relating to water resources, water use requirements and water sources was read into the record by Ms. Minning.
- The discrepancy in water requirements between the coastal route (10 million barrels) and the interior route (3 million barrels) was questioned by the CYI in cross-examination. Mr. Harlan suggested this could be due to differences in snowfall and undertook to examine this more closely.

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11637-11649
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12189-12196

b-13 Water Use (Cont'd)TRANSCRIPT
REFERENCE

- On the North Slope, the Malcolm and Firth Rivers would be used as water sources and ground water (springs) could be used in late winter, according to Mr. Williams and Mr. Harlan in cross-examination by ITC/COPE. The details of water supply at Komakuk Beach on Spread C were explained. About 68,000 barrels per month would be required along with about 50,000 barrels/mile of right-of-way if snow roads had to be made (a worst case situation). The supply would be adequate considering that most of the snow road water would be required in the early winter before the rivers freeze to the bottom. Mr. Williams suggested that the quantity of water should be kept in perspective. The total spread requirement per season (about one million barrels) would be equivalent to drawing a 129 acre lake down only one foot. A critical area for water may be to the west of the Spread C camp in a year of little snowfall.

Vol. 81
12095-12114
- The sensitive areas for water withdrawal, as pertains to fish, are indicated on the alignment sheets, according to Dr. McCart in cross-examination by ITC/COPE. The North Slope is the area of most concern. The construction of Bailey bridges across rivers and streams may be better than culverts from a fisheries viewpoint.

Vol. 84
12556-12580
- The use of water from springs on the North Slope as dictated by fish over wintering populations was described by Dr. McCart in cross-examination by Commission Counsel.

Vol. 85
12730-12737
- The four rivers in the Mackenzie Valley which were identified by PAAG as critical from a water extraction point of view were discussed by Dr. McCart in cross-examination by Commission Counsel. Oscar Creek, it was agreed, was a questionable place from which to extract water. Dr. McCart pointed out that the Mackenzie River was a nearby source that could always be used. The main concern is to maintain fish populations and the short and long term effects on them as a result of water withdrawal. Commission Counsel pointed out the critical water supply problem that occurred at Prudhoe Bay in '73-'74 which required hauling water from 30 miles away and suggested this might happen on the North Slope.

Vol. 85-A
12741-12773

b-14 Waste and Toxic Substances

- A general description of the solid waste and waste water disposal methods was read into the record by Ms. Minning.

Vol. 78
11649-11653
- The effect of the water-methanol test medium on the epoxy coating inside the pipe and the resulting effect the solution might have on fish is a concern that is unwarranted because the coating will be insoluble, according to Mr. Hemstock in cross-examination by ITC/COPE. No methanol solution greater than 1 per cent will be discharged to the environment. Studies on the merits of bladder and steel storage tanks are underway but steel tanks seem to be preferred. Contingency plans for spills to supplement the existing DOE guidelines are currently being developed. The

Vol. 85
12675-12688

b-14 Waste and Toxis Substances (Cont'd)TRANSCRIPT
REFERENCE

- final list of lubricants, etc., that will be used on the project won't be available before final design. In response to cross-examination by CARC, Mr. Hemstock said that where possible non-toxic lubricants will be recommended.
- Details of contingency plans for spills and handling procedures for fuels were requested by Commission Counsel. Mr. Hemstock agreed to outline these matters in Phase III. Vol. 81
11999-12001
 - Sewage disposal details are a matter for final design but would be addressed in Phase III by a Foothills witness who is doing such work for both applicants. Vol. 85-A
12796-12798
 - Solid waste of a non-organic nature would be buried in specified borrow pits, according to Mr. Hemstock in cross-examination by CARC and ITC/COPE. Vol. 81
12001-12005
 - Vol. 80
11915-11917
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b-15 Compressor Stationsb-15-1 Noise

- The compressor stations would be designed to adhere to the Alberta noise standards, according to evidence read into the record by Ms. Minning. Because construction is in the winter when wildlife is very sparse along the right-of-way, the noise impact would be minimal. Vol. 78
11673-11674
- Vol. 82
12202-12203

b-15-2 Power

- Electrical powering for compressor stations adjacent to the Great Bear River had been discussed according to Mr. Hemstock in cross-examination by ITC/COPE. Electrical power would be less noisy than the gas powered turbines and reduce emissions, but the overall environmental impact could be greater when the dam and power transmission lines are considered. If the electrical power existed, it would be given serious consideration. Stations could be converted to electrical power at a later date. If an oil pipeline were built it would have to be powered by gas or electricity. Vol. 85
12693-12708
- As the value of gas increases there will be more pressure to use liquid hydrocarbons to fuel the stations near the gas plants, according to Commission Counsel's cross-examination of Mr. Hemstock. Vol. 85-A
12790-12792

b-15-3 Air Quality

- The emissions from the compressor stations would be kept within the Federal Standards, according to evidence read into the record by Ms. Minning. Mr. Hemstock explained that sulphur content of the gas from the Delta and Prudhoe Bay is low. In cross-examination by Commission Counsel, Mr. Hemstock explained that, although the nitrogen oxide emission figures are higher than the acceptable level under certain conditions, the overall annual figures would be within Standards. Vol. 78
11665-11673
- Vol. 79
11680-11681
- Vol. 85-A
12792-12796

b-16 Frost HeaveTRANSCRIPT
REFERENCE

- The frost heave and thaw settlement considerations in the pipeline design were read into the record by Ms. Minning. In cross-examination by CARC, Mr. Hemstock said that the environmental people are satisfied that the buried, chilled pipeline is of less concern than other modes. In cross-examination by Foothills, Dr. Clark said NES is concentrating on the area south of the Ebbutt Hills to the Mackenzie River in evaluations to determine where chilling should stop. Vol. 78
11629-11634
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11869-11871
- A pipeline on piles, whether elevated or buried, would cost two to three times as much as a buried, chilled pipeline as proposed, and the pile support technique would be about 10 times more expensive than controlling heave by the surcharge berm techniques, according to Dr. Clark in cross-examination by Foothills and in answer to the Judge's questions. Vol. 80
11821-11824
11923-11924

b-17 Mitigative Measures

- The mitigative measures employed in the project, according to evidence read into the record by Ms. Minning, are: (1) route selection, (2) Arctic construction techniques, (3) a chilled pipeline, (4) restoration and revegetation and, (5) drainage and erosion control and slope stabilization. In cross-examination, CARC suggested that additional measures are: (1) the location and relocation of facilities where necessary, (2) aesthetics and (3) contingency planning. Vol. 78
11617-11626
- The question of potential environmental impact if the proposed controls and mitigating measures are unsuccessful, was put to the panel by Commission Counsel. Mr. Williams suggested that the construction impact would be greatest because of the access the project would afford and added that river crossings, stockpile sites and inadequate clean-up would also be a concern. Mr. Hemstock added that the location of the pipeline, if incorrect, could be a long-term concern. In the operation and maintenance stage, failure of mitigating measures would cause concern, in Mr. Williams' view, because of summer repairs, influx of people, unscheduled patrol by aircraft and fires. Mr. Hemstock disagreed with Mr. Williams' order of priority and suggested that the long-term concerns would be: (1) disturbance by surveillance aircraft, (2) the noise from compressor stations and (3) the influx of people to the north and their subsequent hunting and fishing activities. Mr. Harlan viewed the chilled pipeline effects of drainage, slope stability and river crossings as major concerns. Dr. McCart's main concern was the effect on critical areas for fish because of (1) siltation, (2) oxygen level changes, (3) interruption of water flow, (4) obstruction of fish passage, (5) borrow pits on active flood plains and (6) access to fish areas by sport fishermen. Dr. Clark's first concern was for drainage relating to operation of a chilled pipeline. Mr. Hemstock agreed, noting the ramifications of drainage change to local habitats. Vol. 81
11988-11999
- Vol. 82
12235-12242
12257-12285

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b-17 Mitigative Measures (Cont'd)

- The guidelines must be general, leaving site specific application to Arctic Gas and the government inspectors, according to Mr. Hemstock in cross-examination by Commission Counsel. Vol. 83
12488-12491

b-18 Future Development

- Vegetation should be established along the right-of-way before looping, according to Mr. Hemstock in cross-examination by CARC. The impact of a second project hasn't been studied. Other projects should be assessed when they are proposed. The oil pipeline is of no consequence to the routing of a gas pipeline. There would be no problem in constructing an additional facility so no study is warranted. Vol. 81
12010-12016
- NES was not asked to do any studies on looping, according to Mr. Williams in cross-examination by ITC/COPE. Looping would require about 6 million cubic yards of borrow material. Vol. 81
12029-12032
12084-12085

b-19 Abandonment

- The effects of abandonment were outlined briefly in evidence read into the record by Ms. Minning. In cross-examination by CARC, Mr. Hemstock said the present view is to leave the pipe in the ground. Compressor stations would be removed. No environmental studies on abandonment have been done. In cross-examination by Commission Counsel, Mr. Williams suggested that the pipe could be filled with water when abandoned to keep it from floating in buoyant areas. If the frost bulb didn't thaw slowly, settlement would occur, slope problems could be anticipated and erosion would be a problem. Vol. 78
11664
11634-11637
Vol. 81
12006-12010

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12285-12289
12291-12292

b-20 Miscellaneous

- A list of reports prepared by the Northern Assessment Group was tabled by CARC. Vol. 84
12523-12524
- Corrections to the evidence in chief as read into the record were given by Mr. Harlan. Vol. 79
11679-11680

C. Socio-Economic

- nil

D. Miscellaneous

- The Judge instructed counsel to seriously consider the suggestion of Dr. Banfield in Whitehorse that environmentalists representing both sides of an issue appear together to argue their case. Vol. 84
12609-12616

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 88A - 99)

CAGPL - Phase III - Living Environment

YELLOWKNIFE, N.W.T.

NOVEMBER 17 - 21, DECEMBER 1 - 5, 8 - 9, 1975

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TOPIC: Phase III; The Impact of a Pipeline and Mackenzie Corridor Development on the Living Environment

Arctic Gas - Living Environment

DATE: November 17 to 21, December 1 to 5 and 8 & 9, 1975

WITNESSES: Arctic Gas' Phase III Panel consisting of:

R.A. Hemstock:	Director of Environmental Studies & Co-ordinator for Northern Activities, Canadian Arctic Gas
D.L. Dabbs:	Manager, Environmental Division, R.M. Hardy and Associates
Dr. P.J. McCart:	President, Aquatic Environments Ltd.
Dr. W.H. Gunn:	President, L.G.L. Ltd., Environmental Research Associates
R.D. Jackimchuk:	President, Renewable Resources Consulting Services Ltd.
Dr. A.W.F. Banfield:	Professor of Environmental Studies and Director of the Institute of Urban and Environmental Studies, Brock University

HIGHLIGHTS:

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A. Engineering/Technical

a-1 Design Changes

- Arctic Gas announced two design changes: (1) a satellite communications system would be used and,	Vol. 93
(2) a change in the gas plant plans of the Delta Producers (Shell will build its own plant) requiring that the pipeline from the plants go south of Parsons Lake instead of north.	14198-14199 Vol. 98 14862-14863

B. Environmental

b-1 Impact Evaluation

- A general review of the impact assessment process and the organization of the Arctic Gas environmental department was given by Mr. Hemstock. The cost of the assessment to the end of 1975 is \$15,917,000. The work was undertaken for four reasons: (1) to enable Arctic Gas to build a pipeline with a minimum impact, (2) to avoid environmentally related construction stoppages, (3) to collect baseline data and ensure the technical feasibility of acceptable construction practices and (4) to meet the requirements of the various Acts and stipulations.	Vol. 88A 13359-13365 Vol. 89 13503-13509
- An environmental assessment overview was presented by Dr. Banfield in which he described his role in the Arctic Gas project, the process of impact assessment and analysis, the acceptability of the impact, the cumulative assessment and the mitigative measures. In conclusion, Dr. Banfield said he felt that the pipeline, as proposed, would not have a significantly detrimental impact on the components of the living environment. In cross-examination by ITC/COPE, Dr. Banfield agreed that: (1) environ-	Vol. 89 13509-13527

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b-1 Impact Evaluation (Cont'd.)

- mental assessment is an art or science in its infancy, and (2) no single method is generally accepted. The U.S. National Environmental Policy Act was described. In Dr. Banfield's opinion a similar Act in Canada would prevent things like the Dempster Highway proceeding without a public hearing. Dr. Banfield went on to say that when he began work on the Arctic Gas project little engineering had been done. The engineers selected the corridors. The panel said that the environmental matrix developed by the EPB was not very useful except to identify concerns.
- Vol. 95
14371-14381
- Vol. 95
14381-14400
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14400-14408
Vol. 97
14780-14794
- Assumptions under which the impact assessment was made were suggested by ITC/COPE and agreed to by the panel. They were: (1) the pipeline can be built as the engineers say it can be built, (2) the engineers have the ability to overcome any technical problems, (3) the pipeline company employees can be controlled as Arctic Gas says they can, (4) the pipeline will exist in isolation from a road across the North Slope, (5) the project can and will be stopped or delayed if environmental concerns are compelling enough, and (6) the government can create a monitoring agency. Commission Counsel suggested that the prediction of impact ignored the effects of completing the Dempster and Mackenzie Highways, and subsequent developments such as an oil pipeline. Dr. Banfield stated that environmental information on the first project (the highways) was not available and no details are available on subsequent developments such as an oil pipeline. The panel agreed that pipeline routes other than those proposed across the northern Yukon were largely outside their terms of reference as was the consequence of future development in the corridor. Each member of the panel described his terms of reference.
- Vol. 95
14422-14441
Vol. 98
14906-14908
- Vol. 95
14452-14471
- The Garrison Diversion Scheme and the Scottish approach to North Sea oil development were discussed by Dr. Banfield in cross-examination by ITC/COPE. The Judge commented that, in retrospect, Alaskans are now saying there should have been a land use plan before pipeline construction or land claims settlement in Alaska. Dr. Banfield said that, if he were starting the pipeline assessment today, he would consider using the U.B.C. interaction matrix (systems analysis) approach to impact assessment.
- Vol. 95
14496-14505
- The aims of the research, according to Dr. McCart in cross-examination by Commission Counsel, were: (1) to gather baseline information, (2) to determine how the proposed activities would alter the environment and (3) to design methods to bring the impacts within acceptable limits. Alyeska has not been used extensively as a living laboratory because Alyeska has refused to allow Arctic Gas consultants on site, according to Mr. Hemstock.
- Vol. 92
14021-14033

b-2 Highway and Other Developments

- The main emphasis of research has been on the effects of a gas pipeline, according to Mr. Hemstock in cross-examination by the EPB. A highway would have a much greater impact. An oil pipeline, although probably of less impact than a highway, would have more impact than a gas pipeline. The main impact
- Vol. 97
14734-14736

b-2 Highway and Other Developments (Cont'd.)

- results from human access but there are many mitigative measures which could make a highway impact acceptable. Dr. McCart, in cross-examination by Foothills, said he agreed with Dr. Wilimovsky's assessment of an oil pipeline impact being 3 to 5 times that of a gas pipeline and a highway being 6 to 10 times that of a gas pipeline. Vol. 90
13760-13761
- The Judge asked the panel to consider the effect of the Dempster Highway on the northern Yukon since that is the area where the two pipeline applications differ most from an environmental viewpoint, and, in assessing this difference, the impact of the Dempster seems to be significant. Mr. Jackimchuk said the Dempster would have an impact many orders of magnitude greater than a gas pipeline and, if access were uncontrolled on the highway it would pose a distinct threat to the Porcupine Caribou herd. Dr. Gunn said he agreed with Mr. Jackimchuk, and said it was high time the Territorial Councils and DIAND started to consider how to control access to that part of the country. Dr. McCart stated that no preliminary impact assessment was done on the Dempster. Dr. Banfield said the highway goes across the grain of normal migratory routes of animals, birds and people. The influx of people was of greatest concern. The environmental impact was unknown and could remain so because of the "in-house" nature of the government's review process (EARP). He complained of the unavailability of government reports. Dr. Banfield also criticized the PAAG (Pipeline Application Assessment Group) report because it assumes a highway has an acceptable impact. In cross-examination by ITC/COPE, the panel said they would be very concerned if the government responsible for building the Dempster Highway, decided that a road across the North Slope was a good idea. Vol. 94
14290-14296
14318-14320
14325-14336
- Developments that might follow a pipeline were not assessed in reaching impact conclusions, according to all members of the panel in cross-examination by Commission Counsel. Baseline studies incorporated the effects of existing facilities such as barge traffic, winter and permanent roads, airfields, cleared rights-of-way, etc. Vol. 95
14441-14451

b-3 Corridor

- The corridor has already been selected by nature and the government, according to Mr. Hemstock. He took exception to that part of the pipeline guidelines that says the first pipeline shapes the corridor. He pointed to the use of the river, the existence of villages, the Canol and government licenced winter roads, the Mackenzie Highway, the land communications system, etc. There is no difficulty for the gas pipeline and the oil pipeline as it is now known to be located within that corridor. Until the details of an oil pipeline are known, impact predictions cannot be made with any degree of certainty. Dr. Gunn agreed with Mr. Hemstock, emphasizing that the highway with its uncontrolled access, is the greatest concern of all. Dr. McCart agreed that the highway was far more damaging to the environment than a pipeline but the government's environmental studies of the highway are internal working documents that are not available. Without these a corridor assessment Vol. 88A
13393-97
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b-3 Corridor (Cont'd.)

cannot be made. Mr. Jackimchuk agreed that a highway would have greater impact than either an oil or a gas pipeline. An analysis of an oil pipeline can't be made without specific engineering information. Mr. Dabbs indicated similar concerns, pointing out that each project provides experience and data that can be applied to subsequent projects. Dr. Banfield indicated that information on the Dempster Highway would facilitate an overall impact assessment.

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13655-13656

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13660-13663

b-4 Routing

- The reasons for preferring the prime route, from an aquatic viewpoint, were described by Dr. McCart. Dr. Gunn explained why the interior route was better from an ornithologist's point of view and why he had serious reservations about the Cross-Delta alternative. Mr. Jackimchuk outlined his routing recommendations from a mammal viewpoint. Dr. Banfield agreed that lumping all the concerns together, the coastal route was superior. In cross-examination by ITC/COPE Dr. Gunn said he now believes the pipeline could be built along the coast without major damage to birds if his recommendations were carried out. The two routes were determined by others and, Dr. Gunn said, he was only asked to comment. He recommended that the Old Crow Flats be excluded from pipeline construction. Mr. Jackimchuk and Dr. McCart identified the Canning River Basin as an area of concern for both mammals and fish. Construction in that area would be better in summer from a fish biologist's viewpoint.

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14160-14171

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14191-14196

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14338-14345

- Changes in route since the environmental assessment are the Cross-Delta and Fort Simpson realignment proposals, according to Mr. Hemstock in cross-examination by the EPB. The changes were proposed after preliminary evaluation by the environmentalists.

Vol. 97
14771-14780

b-5 Critical and Sensitive Areas

- The critical and sensitive areas for fish and for birds were described by Dr. McCart and Dr. Gunn in their evidence in chief.

- The critical areas for fish were identified regardless of the type of facility proposed, according to Dr. McCart in cross-examination by CARC. If only Alaska gas were to be shipped, the Fairbanks Corridor would be the best from a fish biologist's and mammalogist's viewpoint.

- The cross-Delta fish impact reports will be available within the next few months. The PAAG report identification of sensitive areas is too broad, according to Dr. McCart, because it includes whole rivers such as the Firth and Rat rather than the critical areas within the rivers. Dr. McCart explained how environmental concerns were transferred to particular designs on the pipeline.

- All the staging sites on the North Slope are being examined on a site specific basis to determine mitigative measures, according to Mr. Hemstock in cross-examination by ITC/COPE. Demarcation Bay, Komakuk Beach-Ptarmigan Bay and Shingle Point are of particular concern. All these stockpile sites will be self-contained and won't require aircraft bulk resupply.

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b-5 Critical and Sensitive Areas (Cont'd.)

- Restricted areas from a bird standpoint should include: (1) Old Crow Flats, (2) Yukon Flats (Alaska), and (3) Coastal lagoons on the Beaufort Sea coast, according to Dr. Gunn in cross-examination by ITC/COPE. Mr. Jackimchuk said, from a mammologist's viewpoint, the Old Crow Flats, the Canning River Valley and other similar rivers that flow into the North Slope, the west side of the Mackenzie Delta, the Ramparts and the Ontaratieu River should be avoided. Dr. McCart viewed the coastal lagoons as a restricted area and suggested that activities associated with springs inhabited by fish and the Canning River Valley be highly regulated. Dr. Banfield said the crossing of the main part of the Delta would be unwise but the Cross Delta route as proposed would be acceptable. Dr. Gunn said from an ornithological point of view the old Prime Route around the Delta was preferable to the Cross Delta Route. Also the facilities in the Campbell Hills area would have to be assessed because of the raptor sites there. Mr. Hemstock said this would be done in final design. Dr. McCart, Mr. Jackimchuk and Mr. Hemstock explained how the environmental recommendations were documented and considered in the design process.

Vol. 92
 14000-14001
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 14687-14688
- Additional critical areas for birds, suggested by Commission Counsel and agreed to by Dr. Gunn, were: (1) the Babbage River Delta and Phillips Bay, (2) Demarcation Bay, and (3) the whole Mackenzie Delta, particularly its outer parts. The applicants should stay out of those areas or venture into them with special mitigative measures in hand.

Vol. 97
 14857-14861
 Vol. 98
 14864-14869
- Access limitation periods for the coastal lagoons and spits as proposed by the EPB were good, general guidelines but specific controls should be imposed when needed by monitoring the area, according to Dr. Gunn in cross-examination by the EPB. A similar situation exists along the Mackenzie, and flight limitations need to be worked out with MOT to avoid the migration area and adjacent raptor sites.

Vol. 97
 14794-14803

b-6 Habitat Alteration

- The ponds and lakes inland from the sea coast which are important to birds have not been studied to assess the effects of siltation and sheet erosion, according to Mr. Hemstock in cross-examination by Commission Counsel. The engineers say they can control downstream siltation effects.

Vol. 98
 14889-14894
- The effect of active flood plain gravel mining on snow geese and gyrfalcons will be examined on a site specific basis in final design, according to Dr. Gunn in cross-examination by Commission Counsel.

Vol. 98
 14872-14873
 14894-14897
- The cleared pipeline right-of-way would not lead to any concentration of mammals such as moose and wouldn't cause game management problems, according to Mr. Jackimchuk in cross-examination by Commission Counsel.

Vol. 99
 15028-15033

b-7 Use of DEW Line Sites

- The DEW line sites which are located at about 50-mile intervals and have existing airstrips, gravel pads, etc., are attractive as locations for pipeline facilities along the North Slope, according to Mr. Hemstock in cross-examination by Commission Counsel. This was given some thought in the original planning before the pipeline alignment was moved inshore. The present alignment rules out compressor stations at the DEW line sites

Vol. 98
 14873-14884

b-8 Game Management

- The Mackenzie Delta and adjacent areas are major dispersal points for birds to many parts of the world, according to Dr. Gunn in cross-examination by Commission Counsel. Over 171 species have been identified on the North Slope, and they have an extraordinarily large international annual range. Each reacts differently to disturbance. The birds are not the property of the people of Canada. The annual cycle of the snow geese, swans and golden plover were described to illustrate this point. The State of California maintains snow goose reserves that cost more than \$12 million annually, illustrating the dollar value that people place on this one species. The use of birds for food was beyond the terms of reference of the studies but it is an important factor, according to Dr. Gunn. Vol. 97
14831-14857
- The principal risk for birds comes from increased access but no studies have been done on this, according to Dr. Gunn in cross-examination by Commission Counsel. This should be monitored during and after construction. Vol. 98
14914-14919
- Controlling highway access by convoying, restricting traffic to daylight hours and controlling hunting/fishing with no hunting/fishing zones, strict quota systems, and prohibiting the transport of fish in aircraft would help decrease the impact of development, according to Dr. McCart, Dr. Gunn and Mr. Jackimchuk in cross-examination by Commission Counsel. The data gathered to date on animals, birds and fish would contribute greatly to the development of a game management plan. A crash program is needed to develop such a plan. Commission Counsel suggested that the applicant, as developer, had a responsibility in developing a plan. Mr. Hemstock said that was a policy decision for Mr. Horte, but he would recommend that studies be confined to assessing the pipeline-related impacts in co-operation with a government agency. This has been done already. Dr. Banfield said that the problem in developing a game management plan was related to the fact that the Canadian Wildlife Service is being further and further removed from the scene for political and bureaucratic reasons. Dr. Gunn pointed out that neither the Dempster nor the Mackenzie Highways were completed yet but when they are, the government must accept the responsibility for game management programs that will be needed as a result. Vol. 98
14984-15005

b-9 Cariboub-9-1 General

- The potential interaction of the project with caribou and studies done relating to caribou were described by Mr. Jackimchuk. In response to the Judge's questions, Dr. Banfield and Mr. Jackimchuk listed the size and locations of the various North American and Siberian herds. Vol. 89
13451-13457
- The factors listed in Geist's paper dealing with the effects of disturbance on reindeer are not necessarily transferable to caribou, according to Mr. Jackimchuk in cross-examination by ITC/COPE. Dr. Banfield said the importance of the nursery area and sensitivity during aggregation were over-emphasized. The overwintering range is most important since that is where the cows must nurture the fetus. Vol. 94
14296-14299
- The factors listed in Geist's paper dealing with the effects of disturbance on reindeer are not necessarily transferable to caribou, according to Mr. Jackimchuk in cross-examination by ITC/COPE. Dr. Banfield said the importance of the nursery area and sensitivity during aggregation were over-emphasized. The overwintering range is most important since that is where the cows must nurture the fetus. Vol. 95
14476-14495

b-9-1 General (Cont'd.)

- The effect of the Dempster Highway bisecting the overwintering range of the Porcupine Caribou herd would be critical only if the herd was cut off and had nowhere else to go, according to Mr. Jackimchuk in cross-examination by the CYI. The heavy use of the highway with no mitigative measures could lead to a situation such as in Norway where a road caused abandonment of part of a range. Dr. Banfield and Mr. Jackimchuk agreed with Bergerud's hypothesis that hunting and wolves contributed to major caribou population declines. Vol. 96
14559-14571
- There is need for more research on the effect of the Dempster Highway on the Porcupine Caribou herd, according to Mr. Jackimchuk in cross-examination by the CYI. The use of the Dempster by Arctic Gas in constructing an interior routed pipeline was described. Vol. 96
14618-14631
- Concern that the cleared right-of-way might divert the migrating caribou herd now seems unfounded, according to Mr. Jackimchuk in cross-examination by the CYI. The studies leading to this conclusion were described. Vol. 96
14575-14577
14637-14644
- The impact analysis on the caribou herd was for a gas pipeline and does not purport to assess the impact of other developments, according to Mr. Jackimchuk in cross-examination by Commission Counsel. The significance of the Dempster, which is beyond the applicants' or consultants' control was therefore described separately (see b-2). To make a total assessment of a second project (pipeline) the impact of the first (highway) must be known. Vol. 97
14822-14831

b-9-2 Porcupine Herd

- A paper entitled 'An Analysis of the Impact Potential of the Arctic Gas Pipeline on the Porcupine Caribou Herd' was read into the record by Mr. Jackimchuk. Vol. 89
13465-13491
- In studying the Porcupine Caribou herd more emphasis has been placed on determining methods of avoidance than on determining specific response mechanisms, according to Dr. Banfield and Mr. Jackimchuk in cross-examination by ITC/COPE. During calving and post-calving all aircraft flights would be kept above 2,000 ft. The four years of baseline studies concentrated on distribution and numbers of caribou. Calving and yearling aspects of the herd were described. The population of the herd is dynamic and it is difficult to establish a cause/effect relationship. This is why emphasis has been placed on minimizing contact with pipeline-related activities. The population of the herd is now at a high level. The calving area covers about 4,000 square miles, the post calving aggregation area about 2,000 square miles and the wintering range about 80,000 square miles. The compelling concern of turning back the migrating herd is one reason the coastal route is preferred. Scheduling of construction is the main mitigative measure. This would be achieved by monitoring the progress of the herd. The arrival of the herd at the calving grounds is the most predictable aspect of the herd; usually in the third week in May with the earliest arrival being May 15th. If overwintering caribou are encountered on the route they will be allowed to passively move away. Vol. 94
14244-14282

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14300-14318

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14345-14349

b-9-2 Porcupine (Cont'd.)

- The population dynamics of calves and yearlings were described by Mr. Jackimchuk in cross-examination by the Council for Yukon Indians (CYI). The interior route is not preferred because construction could interfere with the spring migration. Mr. Hemstock outlined how the proposed schedule could conflict with the herd. He pointed out that work would be stopped if necessary, and by reversing the direction of work on spread B the interaction points could be minimized. Mr. Jackimchuk said he felt very strongly that the Canadian Wildlife Service (CWS) or the Yukon Wildlife Service should investigate mitigative measures to be applied on the Dempster Highway. The highway should be monitored full time. If the interior pipeline route were used, restrictions on pipeline-related traffic along the Dempster should be investigated. No research has been done on the effects of pipeline abandonment on the caribou herd.

Vol. 96
 14547-14559
 14644-14658
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 14583-14616
 14631-14637

- If caribou were encountered overwintering on the right-of-way on the North Slope as was reported by McEwen in the 1950's - or because they arrived early, the recommendation would be to shut down the work, according to Mr. Jackimchuk in cross-examination by the CYI and Commission Counsel. Mr. Hemstock pointed out that overwintering populations are normally quite scattered and a complete shut-down wouldn't necessarily be required. Mr. Jackimchuk said that he disagreed with Geist's thesis that habituation-related studies should be undertaken to determine how caribou and industry can co-exist.

Vol. 96
 14667-14681
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 14967-14976
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 15023-15028

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 14976-14984

b-9-3 Forty-Mile Herd

- The forty-mile caribou herd has been decreasing steadily because of much hunting, poor calving success and heavy wolf predation, according to Dr. Banfield in cross-examination by the CYI. The heavy hunting from the Steese Highway may have been one reason the herd withdrew eastward. Many animals may have joined the Porcupine herd.

Vol. 96
 14681-14683
 Vol. 97
 14710-14713

b-9-4 Bluenose Herd

- The Bluenose caribou herd which has been steadily growing and overwintering in the Travaillant Lake to Fort Good Hope area, has not been studied, according to Mr. Jackimchuk in cross-examination by Commission Counsel. Since the herd is expanding westward, conflicts with the pipeline and highway are possible. The herd should be monitored. Studies necessary to make a prediction on the herd would include: (1) population data, (2) patterns of movement and distribution, and (3) population characteristics such as reproduction and survival rates. Commission Counsel suggested that the decrease in populations of the Forty-mile, Newfoundland and Churchill herds after man's intrusion into their range indicates the possible if not probable effect of developments such as a pipeline or highway on the herds in the northern Yukon and NWT. It was agreed that those examples show the magnitude of the risks and the need for mitigative measures. The highway developments are critical but beyond the control of the pipeline applicant.

Vol. 98
 14920-14961

b-10 Other Mammals

- The mammal studies conducted for the project were described by Mr. Jackimchuk in his evidence in chief. Vol. 89
13451-13456
- The movement of moose to and from their over-wintering areas on the islands in the Maknezie River between Wrigley and Fort Good Hope shouldn't be impeded by pipeline construction, according to Mr. Jackimchuk in cross-examination by the NWT Indian Brotherhood/Métis Association. The moose appear to move down to the islands in November and December. Oscar Creek has been identified as a sensitive area for moose, and a report on the effects of the compressor station, etc., proposed for that area is in preparation. Dr. Banfield pointed out that a localized decrease in moose population would be possible as they moved out to occupy other terrain. Vol. 97
14720-14734
- The distribution of musk ox along the North Slope was described by Mr. Jackimchuk in cross-examination by the CYI. The herd was introduced in 1930 and seems to be maintaining itself at a stable population. Calving season occurs in May and June. No disturbance studies were carried out. A recommendation has been made to the applicant to avoid the herd as much as possible. Vol. 96
14536-14547
- Polar and grizzly bears, if troublesome, would be tranquilized and removed with the co-operation of the CWS, according to Mr. Jackimchuk in cross-examination by ITC/COPE. Dogs on the spread are not recommended because they may repel or attract bears. Vol. 95
14360-14363
- Foxes are not likely to become a problem because of their wide dispersal and because of the waste handling techniques proposed by the applicant, according to Mr. Jackimchuk in cross-examination by ITC/COPE. Vol. 95
14363-14366

b-11 Birdsb-11-1 General

- Studies on bird populations, life histories and disturbance were done in representative areas along the route according to Dr. Gunn in cross-examination by ITC/COPE. Concentrations by year and season were of particular interest, giving an idea of natural variations in a given habitat. Along the North Slope 60 lakes were examined for their productivity. This information, keyed to the data on fish by Dr. McCart, will be useful in determining camp locations and water sources. Vol. 93
14125-14142

b-11-2 Snow Geese (See also b-8)

- The North Slope is a staging area for over 300,000 snow geese which, if forced off that site by natural causes, go to the outer Delta area in the vicinity of the cross Delta route, according to Dr. Gunn in cross-examination by ITC/COPE. If they were in the area during construction, the work would be shut down, according to Mr. Hemstock. Compressor stations CA03, CA05 and CA06 should be moved because they are in the goose staging area. In all areas used by geese, controls on plane flights, noise and personnel would be required. Vol. 98
14172-14175
14870-14872
- The ornithologists' recommendation last September to shut down the Shallow Bay dredging operation because of snow geese in the area was ignored, according to Dr. Gunn in cross-examination by Commission Council. Vol. 98
14908-14911

b-11-3 Raptors

- Pipeline facilities within 2.5 miles of known raptor sites should be moved, according to Dr. Gunn in cross-examination by Foothills. An outline of the sensitive areas was given noting that much of the information is controlled by the CWS because of the rare and endangered status of some raptor species. If raptors are disturbed a year's hatch could be lost. Vol. 93
14101-14110
Vol. 95
14409-14410
- More work, as proposed by the CWS, is required to determine the critical zones around peregrine falcon nesting sites, according to Dr. Gunn in cross-examination by Commission Counsel. Vol. 98
14904-14906

b-12 Fish

- Arctic fish populations are resilient in that they can withstand short-term variations that are not catastrophic, according to Dr. McCart in cross-examination by Foothills and Commission Counsel. They have slower growth rates and hence longer lives so that the population is less dependent on one year class for survival. From a fish biologist's viewpoint, the coastal route is preferable to the interior route. Some of the sensitive areas for fish are the Canning River in Alaska, parts of the Firth River and Fish Creek, and Phillips Bay. Vol. 90
13734-13738
13761-13766
Vol. 93
14078-14082
- The domestic fishing sites along the corridor have been identified and will be reported in the Biological Report Series, according to Dr. McCart in cross-examination by CARC. Critical areas for fish are generally those places where a habitat change would lead to a significant decrease in the total population. In cross-examination by ITC/COPE, Dr. McCart said that no studies on restocking have been done. Studies have concentrated on the prevention of damage. Significant fish populations may be evaluated differently by a biologist than by people who depend on the fish resource for food. In cross-examination by Commission Counsel, Dr. McCart said that wherever there is a domestic fishing site he would recommend moving the pipeline as far away as possible. Mr. Hemstock said that such sites would be examined on a site specific basis. Vol. 91
13767-13774
Vol. 91
13934-13937
Vol. 92
13956-13966
Vol. 93
14082-14088
- The current state of knowledge on fish species and gaps in that knowledge were described by Dr. McCart in cross-examination by ITC/COPE. More attention has been given to fish than benthic invertebrates in trying to predict impact. Vol. 91
13912-13934
13943-13952
- The use of river flood plains and terraces and the steps that will be taken to protect aquatic organisms were described by Dr. McCart. The consequences of such operations are being watched on the Alyeska project, according to Dr. McCart in cross-examination by ITC/COPE. Predicting the cause of damage is difficult. Life cycle studies would be useful in such predictions. Vol. 88A
13389-13390
Vol. 92
14005-14011
- As in Alaska, fishing by pipeline workers would be prohibited, said Dr. McCart in cross-examination by ITC/COPE. Fish populations are vulnerable in relatively unproductive northern waters. Access for fishing would be limited since permanent roads aren't presently planned. The prohibition of permanent roads could be a recommendation. Vol. 92
13974-13982

b-12 Fish (Cont'd.)

- Obstructions to fish passage by culverts and berms at river crossings and the significance of sub-surface drainage were described by Dr. McCart in chief. In cross-examination by CARC, Dr. McCart said the swimming performance of northern fish can be extrapolated from government studies. Bridges or elliptical culverts would be preferred to baffled culverts, according to Dr. McCart in cross-examination by ITC/COPE. In cross-examination by Commission Counsel, Dr. McCart agreed that snow bridges could act as temporary barriers if not removed promptly in the spring.

Vol. 88A
 13386-13388
 Vol. 91
 13813-13814
 Vol. 92
 13988-13995
- The Alyeska approach, which has general rather than detailed, rigorous standards, is preferable, according to Dr. McCart in cross-examination by Commission Counsel. A site by site operation is best. The object would be to preserve fish regardless of population size. The populations are being intensively studied. Where knowledge is lacking it would be assumed that fish were there and the necessary precautionary steps would be taken. Environmental inspectors should ensure that this is done.

Vol. 93
 14065-14068
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Vol. 92
 14033-14042
 14047-14051

b-13 Blasting in Watercourses

- Summer blasting is preferred over winter blasting from a fish biologist's viewpoint, according to Dr. McCart. The present plans for the Great Bear River crossing include winter blasting but this could be changed if there was evidence that fish would be harmed. In cross-examination by Commission Counsel, Dr. McCart explained that fish were killed by the blast shock wave which is worse under ice. Buried charges would be used to decrease this effect. In a small stream fish could be confined away from the blasting area. The crossing of the Old Crow River was dry when examined in the winter so blasting would have little effect on fish there.

Vol. 96
 14613-14618
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 14076-14078
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 14197-14198
 Vol. 96
 14688-14690

b-14 Siltation

- The siltation studies were described by Dr. McCart in chief. Generally, char eggs are the most susceptible to siltation load increases.

Vol. 88A
 13382-13384
- The berm construction technique for crossing the Great Bear and Mackenzie Rivers was described in Foothills cross-examination of Dr. McCart. Culverts would be used through the berm as necessary to reduce velocities to a level acceptable to spawning fish. Generally velocities would be 6 feet per second or less. Dr. McCart said that further work is required to assess the consequences of siltation caused by end dumping during berm construction.

Vol. 90
 13738-13760
 Vol. 91
 13775-13777
- A single siltation standard wouldn't be appropriate for the wide variety of streams along the route, according to Dr. McCart in cross-examination by CARC, because it would not necessarily protect the fish resource. A site specific determination would be required by a competent fish biologist. The difficulty lies in setting quantifiable limits which would be applicable to a wide variety of streams. In some places a river crossing plan similar to a borrow site development plan, would be prepared. Monitoring of the Inland Gas System work shows there is no significant increase in siltation downstream of a crossing. ITC/COPE pointed out that on the Pointed Mountain Line a crossing has been causing siltation for more than a year.

Vol. 91
 13814-13821
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Vol. 91
 13824-13833
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Vol. 92
 13966-13974
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 13982-13988

b-14 Siltation (Cont'd.)

- The Loon River crossing, as described in the stream catalogue, was selected by Commission Counsel as an example to illustrate what information is known and would have to be known for a river crossing. Dr. McCart explained where there were overwintering fish, settling basins could be used to minimize siltation. Vol. 92
14042-14047
- Studies show that siltation is not significant 400 to 800 meters from the source, according to Dr. McCart in cross-examination by Commission Counsel. The turbidity isn't as much a problem as what settles out on the bottom. Vol. 92
14051-14059

b-15 Spills and Toxic Substances

- The effects of methanol on vegetation and fish were described by Mr. Dabbs and Dr. McCart in their evidence in chief. In Foothills cross-examination, Mr. Dabbs indicated that further methanol studies with respect to vegetation were necessary. Vol. 88A
13377-13378
13392-13393
Vol. 89
13561-13565
- Terrain-related tests on methanol spills were described by Mr. Dabbs in cross-examination by CARC. Pure methanol spill tests were not necessary because it is known that such a spill would kill plants. Future tests will be done in the treeless tundra terrain. Sites of previous tests are being sampled on an ongoing basis to evaluate the recovery. Dr. McCart said that no studies have been done on the behavior of methanol in water, but it is known to generate heat when mixing occurs, and to reduce the growth rate and shorten the hatch time of eggs. No studies have been done to investigate the effects on fertilization. At high concentrations the methanol causes temporary blindness in fish. No methanol tests have been done in the field on fish. Vol. 90
13604-13614
Vol. 91
13834-13843
- It would be preferable to meter the discharge of the methanol solution to the Mackenzie rather than dump it on the ice, according to Dr. McCart in cross-examination by ITC/COPE. Methanol is readily broken down naturally. No tests have been done to evaluate the synergetic effects of methanol plus a high silt load. Vol. 95
14474-14476
Vol. 92
13995-13997
- Methanol solutions of a concentration no greater than 1% will be disposed of on the ice of rivers, according to Dr. McCart in cross-examination by Commission Counsel. Methanol has been shown to affect fish eggs at concentrations of .001% and it is possible that there are spawning areas in the Mackenzie River. Mr. Hemstock explained the diking type of contingency plans that would be used if the concentrated methanol solution leaked out of the pipe during a test. Vol. 93
14068-14076
- Test for spills and other toxic substances such as fuel oil, synthetic lubricants, etc., are being done under the Environmental-Social Program and ALUR, according to Mr. Dabbs in cross-examination by CARC. If there were such a spill it might be necessary to remove some soil before attempting to revegetate. Otherwise, physical erosion control measures would have to be relied on. Vol. 90
13614-13620
- Spills could cause a taste change in fish locally, according to Dr. McCart in cross-examination by ITC/COPE. If there were a spill, dispersants would not be used. Dr. Banfield described the use of chalk in the cleanup of the Torrey Canyon oil spill Vol. 92
14011-14016

b-15 Spills and Toxic Substances

disaster in Britain. In cross-examination by Commission Counsel, Dr. McCart explained that no large oil spills would result from a gas pipeline and chalk would not be used where oil was spilt. Mr. Hemstock pointed out that there already exists spill absorption and collection equipment at strategic locations along the Mackenzie and that equipment would be expanded as required if the pipeline project were to go ahead.

Vol. 92
14019-14021

- The consequence of an oil spill on birds was described by Dr. Gunn in cross-examination by Commission Counsel. Generally, the best solution is to contain the spill. Dispersants should not be used.

Vol. 98
14869-14870
14884-14888

b-16 Aircraft Flights and Disturbance Studies

- There would be about 1 to 3 flights per month at about 150 feet along the right-of-way for monitoring purposes during the pipeline operations stage, according to Mr. Dabbs in cross-examination by Foothills. Counsel for Arctic Gas advised that during construction there would be an average of four fixed wing aircraft flights per day per spread.

Vol. 90
13732-13734

- The disturbance studies as described by Dr. Gunn in chief involved studies on the effects of human presence, aircraft and noise of construction and operations on waterfowl and snow geese.

Vol. 97
14715-14717

- The disturbance effects of aircraft flown at various altitudes on various species of birds were described by Dr. Gunn in cross-examination by Foothills. Helicopters have a greater disturbing effect than fixed wing aircraft. Foothills suggested that various raptors weren't as disturbed by turbine helicopters as fixed wing aircraft and gyrfalcons tended to dive on helicopters. They also suggested however that studies by the CWS concluded that falcons were more disturbed by fixed wing aircraft than helicopters. Dr. Gunn said that snow geese tended to be disturbed at a greater distance by a helicopter but took longer to settle down after being disturbed by a fixed wing aircraft. All reactions were relative to the season, species and previous exposure. Arctic Gas accepted the recommendation that fixed wing flights be kept above 2,000 feet in ornithologically sensitive areas. Mr. Hemstock indicated that line inspection flights would have to be at a lower altitude but that they could be varied.

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13410-13423

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14110-14123

- The compressor station noise simulator study done on birds on the North Slope was described by Dr. Gunn in cross-examination by ITC/COPE. Dr. Banfield said this work was undertaken by Arctic Gas on his recommendations after observing animal and bird activity around compressor stations in southern Alberta. Dr. Gunn said the noise caused a loss of snow goose feeding grounds for a 2½ mile radius of the station. The test was for noise only and didn't attempt to simulate human presence, aircraft activity etc. During construction, workers will be confined to the construction sites.

Vol. 93
14143-14154
14175-14195

- Flight altitude restrictions are already applied to exploration companies operating in the Delta and pose no major problem, according to Mr. Hemstock in cross-examination by ITC/COPE. Dr. Gunn suggested that flight controls could be implemented by requiring all flights to be IFR rather than VFR.
- Follow-up tests have not been done to evaluate the long-term effect of disturbance, according to Dr. Gunn in cross-examination by the CYI. The Fairbanks corridor would avoid the areas of greatest importance to birds in northwestern North America. Mr. Hemstock said he had no reservation about the list of recommendations submitted by Dr. Gunn. Vol. 96
14690-14704
- Disturbance tests should be done using the specific types of aircraft selected by Arctic Gas once these are determined, according to Dr. Gunn in cross-examination by Commission Counsel. Generally the Twin Otter causes less disturbance than other aircraft of comparable size. Hovercraft would be acceptable in winter but would be highly objectionable in summer. Mr. Hemstock said Twin Otters would be used as a service aircraft and a piper-type aircraft would be used in routine operations surveillance. Vol. 98
14897-14904
- A minimum flight altitude of 2,000 feet would minimize mammal disturbance, according to Mr. Jackimchuk in cross-examination by ITC/COPE. The noise simulator test didn't provide any information on the visual, scent or other disturbances. No studies were done or are planned to assess the acceptable frequency of flights per hour for caribou. Vol. 94
14282-14290
- Mr. Jackimchuk said he generally agreed with the stipulations relating to mammals in the EPB code, when cross-examined by the EPB. He pointed out that a flight altitude of 300 feet was the threshold and he recommended 1,000 feet to be sure. The Code's recommendation of 2,000 feet was even better. The application of the recommendations was a problem for the applicant to deal with through its chain of command. Vol. 97
14810-14821

b-17 Vegetation

- The objects of the vegetation program are: (1) to assemble baseline data and, (2) to develop a revegetation program, according to Mr. Dabbs in his evidence in chief. The program and surveys were described. The work has led to the conclusion that no harmful impact on the plant communities would result from the use of the commercial varieties of grasses proposed for revegetation. The availability of commercial varieties of seeds was described. The Inuvik snow road test indicated that snow roads do not impose an unacceptable impact on vegetation. Vol. 88A
13365-13380
- The definition of the landscape into "ecologically meaningful units" is done, according to Mr. Dabbs in cross-examination by Foothills, through four steps: (1) organizing by broad climatic influence, (2) dividing into physiographic units, (3) dividing by landform and (4) selection by microclimate and material select communities. The Chick Lake study area was selected as a mid Mackenzie Valley study area which will be used to confirm the environmental impact predictions. The object of the Prudhoe Bay, Sans Sault and Norman Wells revegetation test areas was to test the germination of various species. The commercial varieties proposed are related genetically to those already existing in the north. There is no danger of these species supplanting native species. Vol. 89
13531-13536
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13536-13538
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13546-13557

- except, perhaps, in disturbed areas. Agronomic varieties are needed for erosion control but native seed will be used in the mix for long-term protection. Two types of agronomics are released by the Department of Agriculture but are not licenced. This was explained by Mr. Dabbs in cross-examination by ITC/COPE.
- Vol. 89
13565-13570
- Vol. 90
13714-13722
- A mix of seed is used to decrease the chances of failure, according to Mr. Dabbs in cross-examination by CARC. All the necessary seed is available but if one variety proves more successful, a lead time of two growing seasons would be required to obtain the required quantity of seed. The seed would be applied in winter from a truck with aerial spring dressing as required. The seed and fertilizer would be stockpiled at compressor station sites and ferried by helicopter to the aerial seeding location. This operation would be timed so that it wouldn't interfere with birds or mammals (caribou calving) in the area. The trampling and cropping effect of caribou on the vegetation is not expected to be significant. Very localized erosion problems might result, according to Mr. Jackimchuk. The ground maintenance crew could remedy such problem areas. The overall damage to the revegetated sections caused by birds cropping the area would likely be quite small according to Dr. Gunn in cross-examination by CARC and Commission Counsel. Mr. Dabbs pointed out that in designing plans for the drainage and erosion control it was assumed revegetation wouldn't be effective for the first 3 to 5 years.
 - The revegetation program is for long-term surface soil erosion protection, not for restoring the permafrost, according to Mr. Dabbs in cross-examination by ITC/COPE. The revegetative program would take 1 to 3 years to establish. The agronomic varieties would be gradually replaced by native species. Observations don't confirm the fear that agronomic varieties would persist for a long period.
 - Trees cleared from certain parts of the Delta wouldn't necessarily be succeeded by similar vegetation, according to Mr. Dabbs in cross-examination by ITC/COPE. ITC/COPE suggested that this problem could extend as far south as Arctic Red River.
 - There is no evidence to indicate that the pipeline would cause an increase in fires, according to Mr. Dabbs in cross-examination by Commission Counsel. Fires are a natural component of the landscape. Mr. Hemstock said there were no specific contingency plans for fires. Summer construction would be limited to compressor station sites so that work could continue through high fire risk seasons.
 - There would be no permanent damage to the vegetation and subsoil from the use of snow roads if patterned on the Inuvik test road, according to Mr. Dabbs in cross-examination by Foothills. In cross-examination by CARC, Mr. Hemstock said the criteria for snow road construction is sufficient cover to protect the vegetative mat. If vehicles broke through, the road would be abandoned.
- Vol. 90
13571-13576
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13557-13561
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13582-13590

b-18 TimberTRANSCRIPT
REFERENCE

- Timber cut from the right-of-way could be used for pilings required by the Delta Producers and Arctic Gas, according to Mr. Hemstock in cross-examination by ITC/COPE. Some timber could be chipped and used as insulating material on the right-of-way. The regulatory authorities would specify what would be done with the cut timber in the clearing permit. In cross-examination by Commission Counsel Mr. Dabbs said the timber could be left for use in the communities. Vol. 90
13680-13692
- Vol. 90
13729-13730

b-19 Wilderness and Parks

- The pipeline would have little impact on wilderness values because the area to be traversed is already disturbed, according to Mr. Hemstock in cross-examination by Commission Counsel. The panel agreed that there was more pristine wilderness on the interior route than on the coastal route. Dr. Banfield's definition of wilderness described man as a co-partner with the natural environment. Mr. Hemstock pointed to the Man and the Biosphere Program which set areas aside when industrial development requirements were being considered. He felt more park and wildlife areas should be set aside in the North. The coastal area has already been disturbed, however, with DEW line sites etc. The interior region would be more conducive to a wilderness area. Dr. Banfield suggested that the way to preserve wilderness was to define industrial areas rather than vice versa. The background of the proposed International Wildlife Range was described by Dr. Banfield. As the Alaskan Range now stands, pipelines are not prohibited. Vol. 99
15052-15056
- Vol. 99
15057-15082
- Recreation areas as set out in the PAAG report would be reviewed by Arctic Gas, according to Mr. Hemstock in cross-examination by Commission Counsel. Vol. 99
15082-15083

b-20 Archaeology

- The archaeological evaluation in the N.W.T. would be re-done based on the techniques utilized by Reeves in his work in the Provinces, according to Mr. Hemstock in cross-examination by Commission Counsel. The Reeves' approach was described. Arctic Gas would not do off right-of-way excavations or excavations within the right-of-way unless sites were going to be disturbed in construction or operation of the pipeline. There will be an archaeologist on each spread to do ditch wall examination. Commission Counsel asked that Arctic Gas detail its archaeological plans for the project. Vol. 99
15090-15104

b-21 Aesthetics

- A landscape architect will be involved in final design to work mainly on compressor stations and similar above-ground structures, according to Mr. Hemstock in cross-examination by Commission Counsel. Local people will be consulted after certification during final design on the immediate location and general aesthetics of the pipeline in their area. Vol. 99
15083-15090

b-22 Bonding and Compensation

- Compensation to local people for damages would be complicated because of the difficulty in assessing cause, e.g. whether such things as a decrease in fish catch were due to natural variations, the pipeline or the highway, according to Dr. McCart in cross-examination by the N.W.T. Indian Brotherhood/Métis Association. In the case of fish there is Vol. 91
13901-13912

also lack of baseline data. Mr. Horte had suggested that compensation should be handled in the usual way in the courts with the onus on the claimant to prove his case. Counsel for the Brotherhood suggested the onus be shifted to the pipeline company to prove that it didn't cause the loss. Mr. Hemstock suggested that a Board consisting of government, pipeline and local people could be established. The Judge suggested that if the pipeline company failed to comply with regulations, it would then be required to prove non-responsibility for the cause of damage. This would provide an inducement to adhere to the regulations.

- A performance bond in the amount of 1% of the capital cost of the system wouldn't be warranted, although there is nothing wrong with the idea, according to Mr. Hemstock in cross-examination by the CYI. A lesser amount assigned on a spread basis would be better. The responsibility - particularly in the long-term - belongs to the government. This is particularly true for such things as caribou herd management. Tax revenue from the pipeline could be used for such projects. Vol. 96
14658-14667
- The pipeline will be blamed for decreases in game whether it is responsible or not, noted Mr. Jackimchuk in cross-examination by ITC/COPE. It would be very difficult to establish cause-effect relationships. Dr. Banfield noted that the literature shows there are long-term natural fluctuations in caribou herd size. Strict regulations on the Dempster Highway would probably be effective in bringing the impact of that project within acceptable limits. Vol. 94
14349-14359

b-23 Inspection and Surveillance

- A CPM type of project control containing environmental constraints will be used, according to Mr. Hemstock in cross-examination by ITC/COPE. In cross-examination by Commission Counsel, Mr. Hemstock said work has started on CPM type environmental charts which will form part of the operation and maintenance contingency plans. These plans will consist of about six typical base case situations which would have specific condition overlays. Commission Counsel asked that a CPM chart be produced so the technique of incorporating environmental concerns could be examined. Vol. 95
14410-14422
- Environmental inspectors would have a degree in natural science and would answer to the Arctic Gas man on the spread, according to Mr. Hemstock in cross-examination by ITC/COPE. A training program is being developed. Hunting, fishing and aircraft flight restrictions will be discussed with the appropriate authorities. MOT is already working on flight control techniques, according to Dr. Gunn. Vol. 95
14505-14518
- Some type of environmental code would be desirable along with an education program, according to Dr. Gunn in cross-examination by the EPB. Dr. McCart said that it is ultimately the responsibility of government to ensure recommendations are part of the terms and conditions and to ensure enforcement. The applicant is also responsible. Vol. 97
14803-14805
Vol. 97
14806-14810
- Competent people are needed in the field to detect problems before they occur, according to Dr. McCart in cross-examination by Commission Counsel. Three people would be required on each of the 9 spreads. Monitoring during operation and maintenance will include surveillance of the line, checking such things as the caribou migration and preparing detailed Vol. 93
14088-14100

follow-up baseline studies such as those done at Chick Lake. Dr. McCart outlined the three major classifications of streams and said that the measures to minimize stream disturbance were: (1) to gather baseline data, (2) to determine the expected habitat changes and tolerance levels and, (3) to specify the methods to keep changes within tolerance levels. Three areas looked at are: (1) sedimentation, (2) methanol effects and (3) dissolved oxygen (critical for Arctic Char). Commission Counsel asked that Arctic Gas assemble its monitoring program to show what would be monitored, when monitoring would be done and the purpose of the monitoring. Vol. 99
15047-15052

- The Environmental Manual would outline what contractors must do, and legal staff at Arctic Gas would ensure the necessary requirements were included in contracts and sub-contracts, according to Mr. Hemstock in cross-examination by Commission Counsel. Vol. 99
15044-15047
- The job of the environmental inspector is to foresee problems to make sure that construction goes ahead smoothly, according to Mr. Hemstock in response to the Judge's question. He would work closely with government people. No breach of ethics would occur in doing so. Vol. 91
13821-13824
- The Judge noted that many of the promises made by the applicants, regarding such things as restriction of personnel to camps, are beyond the applicant's legal right. He asked the applicants to give that some thought. Vol. 95
14513-14521

b-24 Training and Education

- Employees of the company - be they native or otherwise - wouldn't be allowed to trap while on the job or housed on the job, according to Mr. Hemstock. Similar policies regarding fishing and hunting would be desirable. Vol. 95
14366-14371
- A report on employee training on the job and before arrival on the job should be ready by phase IV of the Inquiry, according to Mr. Hemstock in cross-examination by ITC/COPE. Vol. 95
14521-14522

b-25 Miscellaneous

- Mr. Jackimchuk explained his views on complaints received in Old Crow about his company harassing caribou. Vol. 96
14705-14706
Vol. 97
14713-14715
- Arctic Gas filed as exhibits a report by LGL summarizing their ornithological recommendations for the gas pipeline and a report by Aquatic Environments on domestic fisheries. Vol. 91
13834
Vol. 93
14062
- Thirty five volumes of the Arctic Gas Biological Report Series were filed as exhibits. Vol. 88A
13357-13358
- The three volume FPC staff draft environmental impact report was provided to the Judge by Arctic Gas and summarized by Foothills. Vol. 97
14717-14720
14822

C. Socio-Economic

Nil

D. Miscellaneous

- The Canol project was briefly described by Mr. Hemstock. Vol. 93
14063-14065
- Foothills filed approximately 29 responses to requests for information by the Inquiry. Vol. 88A
13345-13353
- The Counsel for Yukon Indians requested that the Judge send someone to the Yukon communities along the Fairbanks route. The Judge said that the Fairbanks corridor may be beyond the Inquiry's terms of reference and asked counsel to discuss the CYI request. Vol. 95
14523-14531
- The Judge outlined his views on the tasks before the Inquiry and counsel gave their views on the need for a "regulations phase" in the Inquiry. Vol. 97
14737-14771

E Inquiry Schedule

The proposed schedule for 1976:

January

- 5 - 9 no sitting.
- 12 - 16 Yellowknife formal hearings, cross-examination of the EPB and last of phase II & III evidence.
- 20 - 30 Inuvik - Formal hearings on the Delta Producers facilities.
- Community hearings at night.

February

- 2 - 6 no sitting.
- 10 - 12 Inuvik - Formal hearings on cross-Delta route, COPE evidence and MADGAG (note MADGAG may be included in January)
- Community hearings at night.
- 23 - 27 no sitting

March

- 1 - 12 Community hearings: Tuktoyaktuk, Sachs Harbour, Holman Island and Paulatuk.
- 15 - 26 Yellowknife formal hearings on phase IV.
- 29 - April 2 no sitting.
- April 5 - 9 Yellowknife formal hearings.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NO. 86 TO 88)

FOOTHILLS: AIR, WATER AND TERRAIN EVIDENCE

Yellowknife, N.W.T.

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TOPIC: Phase II: Impact of the Pipeline and Mackenzie Corridor
Development on the Physical Environment

Foothills: Air, Water and Terrain Evidence

DATE: November 13, 14 and 17, 1975 in Yellowknife.

WITNESSES: Foothills phase II panel consisting of:

L.W. Bouckhout: Manager of Environmental Affairs,
Foothills Pipe Lines Ltd.

C.W. Drew, Jr.: Geologist, Sproule and Associates Ltd.

D.M. Davidson: Director, Klohn Leonoff

F.B. Claridge: Executive Engineering
Klohn Leonoff Consultants Ltd.

Dr. H. Vaartnou: President, Vaartnou and Sons Ltd.

N.A. Lawrence: Consultant retained by Associated Engineering
Services Ltd.

J.R. Taylor: Principal, Lombard North Group Ltd.

Dr. B.O. Reeves: President, Lifeways of Canada Ltd.

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Technical/Engineering

Nil

B. Environmental

b-1 Terrain - General

- The general terrain environmental guidelines suggest- Vol. 88
ed by Commission Counsel and agreed to by 13200-13208
Mr. Bouckhout were: 1) land should not be un-
necessarily disturbed, 2) aesthetic values should
be protected, 3) wilderness areas should be maintained,
4) disturbance to the ground surface should be
minimized, 5) resources in short supply should be
properly allocated, 6) land use conflicts should be
minimized, 7) archaeological and historical sites
should be protected, 8) disturbed areas should be
stabilized and restored.
- The terrain sensitivity rating was described by Vol. 86
Mr. Drew along with the general physical and 12817-12823
environmental terrain impact of the Yellowknife and Vol. 87
Pine Point laterals. In cross-examination by 13180-13193
Arctic Gas, Mr. Drew described his sensitivity rating
as the terrain's ability to revert to its natural
state under summer conditions. It is based on a
one to four scale. It would be useful in the operations
and maintenance stages when crews determine the
access route to any point on the line. In cross- Vol. 88
examination by Commission Counsel, Mr. Drew said 13223-13234
the rating would be a tool in selecting environmental
remedies. Commission Counsel asked Arctic Gas to Vol. 87
provide the sensitivity map it had prepared. 13193-13194

b-2 Drainage and Erosion

- Drainage disruption, erosion and slope stability were described by Mr. Davidson as the main terrain-related environmental problems. The studies on erosion, slopes, slope failures, drainage and siltation were described by Mr. Claridge with the aid of slides. Vol. 86
12825-12827
Vol. 86
12829-12849
- Most streams would be crossed near their mouth which will decrease the impact, according to Mr. Claridge in cross-examination by Commission Counsel. Stream diversion would be achieved with culverts or diversion channels thereby minimizing siltation problems. Vol. 88
13308-13312

b-3 Borrow Material

- The D.I.A.N.D. and D.P.W. granular resources inventory was relied on in assessing borrow sites, according to Mr. Bouckhout in cross-examination by ITC/COPE. About 18 million cubic yards would be required on the main line exclusive of trench backfill requirements. Active flood plain sites would not be used. The biological team checked the sites this summer. The D.I.A.N.D. inventory was described by Mr. Davidson, who suggested that it underestimated the resources. The Fort Good Hope rerouting will make it unnecessary to use the community gravel source. No discussions have been held with the producers to evaluate their requirements. Of the total resource available about 7 to 17 percent would be required for general fill and 0.6 to 2.3 percent would be required for concrete aggregate. The requirements of future users will be taken into account. Vol. 86
12891-12921
Vol. 87
13059-13074
- An assessment of material quality at each site hasn't been made yet, according to Mr. Bouckhout in cross-examination by Arctic Gas. Vol. 87
13170-13180
- The percentage figures quoted (see above) were very general and meant as indicators only, according to Mr. Bouckhout in cross-examination by Commission Counsel. The borrow locations were identified by engineers from the D.I.A.N.D. inventories. Borrow would be supplemented by dredging in the Mackenzie River. The amount, location and environmental impact of dredging hasn't been studied yet. Vol. 88
13312-13324

b-4 Revegetation

- The revegetation program was outlined by Dr. Vaartnou. Native grasses and naturalized landraces of agronomic species would be used rather than agronomic varieties (as proposed by Arctic Gas). Contracts to grow seed will be left for the spring of 1976. Vol. 86
12853-12870
- The right-of-way would be seeded from a helicopter and difficult areas seeded from ground equipment, according to Dr. Vaartnou in cross-examination by ITC/COPE. Seeding would be supplemented with shredding and planting of cuttings. Less fertilizer would be used than proposed by Arctic Gas. Two to three years would be required for the establishment of the revegetation program. Dr. Vaartnou said he disagreed with Arctic Gas on the matter of seed production. Enough seed of the type proposed by Foothills can be produced but it must be grown north of 55° latitude. Seeding would take place when construction is finished with two monitoring trips during the first summer. The first would be three to four weeks after seed germination. Vol. 86
12921-12953

b-4 Revegetation (Cont'd)

- The difference in the use of native and naturalized landraces as proposed by Foothills, and the use of agronomics by Arctic Gas was reviewed by Arctic Gas in cross-examination of Dr. Vaartnou. Dr. Vaartnou said the agronomics would hinder the establishment of a self-supporting ecosystem. Some native varieties grow as fast as agronomics and are therefore just as effective in erosion control. The re-establishment of a self-sustaining ecosystem is more important than erosion control. The program for seed production was described. Dr. Vaartnou said he was optimistic that the seed could be produced and the northern revegetation program would meet the objectives. Vol. 87
13123-13163
- The native varieties are more suitable than introduced varieties for erosion control even if they don't grow as quickly, according to Dr. Vaartnou in cross-examination by Commission Counsel. The reseeding program and use of seedlings was described. The program hasn't yet been tested north of 60° but next year will be the start of a three-year program. The shredding concept has not been tested north of 60° although there is a proposal to do so. Vol. 88
13325-13338

b-5 Water and Waste Systemsb-5.1 General

- Water supply, sewage and solid waste disposal systems were described in general by Mr. Lawrence who was a consultant on these matters to both Arctic Gas and Foothills. Vol. 86
12873-12879
- The facilities which might be used at the Komakuk Beach Camp on the north slope were described by Mr. Lawrence in cross-examination by ITC/COPE. A mechanical sewage treatment plant would be used with effluent disposal to a site which is not yet determined. Typical treatment plants were illustrated. Lagoons would not be used for non-permanent facilities but would be used as backup at future compressor station sites. The water supply problem has been looked at in general terms only and no problem is anticipated. Vol. 86
12988-12991
Vol. 87
13116-13122

b-5.2 Water Supply

- No site specific work on water supply has been done but airphoto work will start soon to identify useable sources according to Mr. Lawrence in cross-examination by ITC/COPE. Since the sources aren't known the location and length of haul roads aren't known. Source identification will come after the finalization of the compressor station sites, according to Mr. Bouckhout. Mr. Lawrence agreed that there were problems on the Alyeska project because of underestimating the per capita water consumption. It is reported to be as high as 150 gallons/person/day. The present plan is to store water on site in an 80,000 gallon tank. Vol. 86
12953-12967

b-5.3 Sewage Treatment

- The facilities in communities along the route, most of which use "honey buckets" most are ages behind those modules proposed for the camps, Mr. Lawrence agreed in cross-examination by ITC/COPE. The communities would have the right of first refusal on camp equipment after construction but the equipment would be virtually useless because it wouldn't be designed for their use and would be expensive to maintain. Chlorination of sewage effluents would not be recommended. Generally effluent discharge would be to swamplands rather than running water. Vol. 86
12967-12978
Vol. 86
12979-12988

b-5.3 Sewage Treatment (Cont'd)

- Secondary treatment using mechanical treatment plants or lagoons is the objective for all sewage disposal, according to Mr. Lawrence in cross-examination by Commission Counsel. Lagoons would be used as backup during construction camp operation. Lagoons would not be built in ice-rich permafrost, instead, natural pot hole slews would be used. Little thought has been given to lagoon abandonment. The modular nature of the treatment plants would permit expansion of the facility and allow one module to act as backup to the other. Vol. 88
13234-13251

b-5.4 Solid Waste

- Non-organic wastes would be disposed of in government approved sites such as the central disposal areas now designated, according to Mr. Lawrence in cross-examination by Commission Counsel. Burial locations would be marked. Organic wastes would be incinerated. Vol. 88
13251-13258

b-6 Aesthetics

- The process of aesthetic evaluation, the parameters and areas of special aesthetic concern were outlined by Mr. Taylor. Vol. 86
12881-12883
- The wilderness quality would be regarded in a different way by native northerners than by people from the south, according to ITC/COPE in cross-examination of Mr. Taylor. In answer to the Judge's question, Mr. Taylor pointed out that most southern people view the north as an area to be exploited and developed. It was agreed that the Mackenzie corridor has already been aesthetically damaged by seismic and other developments. ITC/COPE suggested that aesthetics were a matter of personal judgement subject to personal bias. A person from the south would have a southern oriented bias. Mr. Taylor disagreed. The Judge pointed to the evidence heard in the communities where people speak of the bush as part of themselves and liken destruction of the land to the loss of a limb.
- Aesthetic work on the project includes: (1) an inventory of known visual features, (2) a review of past studies and, (3) a review of physiographic characteristics, according to Mr. Taylor in cross-examination by Commission Counsel. The location of compressor stations is a matter of concern with respect to noise, visual features and proximity to people. The laterals are currently being reviewed. Aesthetic inputs to borrow pit development would include visual accessibility, shapping of pits, revegetation etc. Feedback from communities would be useful on aesthetic matters and this would be obtained through a community liaison program. Vol. 88
13291-13303

b-7 Archaeology

- The purpose of the preliminary archaeological study of the pipeline and the general nature of the role during construction was described by Dr. Reeves. In cross-examination by Arctic Gas, Dr. Reeves said no ground reconnaissance has been done to date. The archaeological process will follow four steps: (1) identification of potential sites from air-photos, (2) on-site examination, (3) investigation of the route after clearing and (4) examination of the ditch and spoil mound. Vol. 86
12885-12889
Vol. 87
13163-13170

b-7 Archaeology (Cont'd)

- Artifacts would be left in northern museums, according to Dr. Reeves in cross-examination by ITC/COPE. Vol. 87
13074-13099
The most significant sites would be found in advance of the construction process. The cleared right-of-way would also be examined for sites. The walls of the ditch and spoil pile would be monitored. In response to the Judge's questions, Dr. Reeves said the potential for discoveries in the Mackenzie Valley is lower than in the Old Crow Basin. Dr. Reeves agreed with ITC/COPE that Native people should be consulted in evaluating the significance of finds.

- Archaeological sites are protected under statute and will be further protected by monitoring, according to Dr. Reeves in cross-examination by Commission Counsel. When a site is located ahead of the ditcher the measures that could be taken include: (1) moving the line, (2) doing a salvage excavation and, (3) flagging the area and returning after the pipeline is laid. Dr. Reeves agreed with the archaeological site evaluation criteria outlined in the Environmental-Social Program Report*. The steps to be taken between clearing and ditching, if a site is found, are: (1) evaluate, (2) advise government and other interested groups, (3) receive input from the company and others and (4) carry out the salvage decision. Commission Counsel suggested that the seriousness of the proposal is questionable since there would be little time to do all the things proposed. No consideration has been given to incorporating archaeological considerations in the pipeline contractors' contracts, according to Mr. Bouckhout. Environmental inspectors on the job would watch for archaeological evidence and would have access to a trained professional. This type of monitoring has never been done before in North America. There are no estimates of archaeological manpower requirements yet. Vol. 88
13258-13272

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13278-13291

b-8 Environmental Input

- The organization and input to the Foothills project of the environmental staff was described by Mr. Bouckhout. Vol. 86
12810-12815

- The environmental education program would be on two levels: (1) one for the work crews and (2) one for the people responsible for field application, according to Mr. Bouckhout in cross-examination by Commission Counsel. A manual of environmental protection measures would also be prepared. No work has been done on it yet, but the hope is to work together with the government agency on the manual. Experience on the Mackenzie Highway and on the Alyeska project would be taken into account. A team of thirty to fifty environmental inspectors would be required. The spread inspectors would report to a district chief who would report to head office. The powers of the spread inspector and his qualifications have not yet been finalized. Foothills is very interested in the government's thinking and plans on these matters. Vol. 88
13209-13215
Vol. 88
13216-13223

C. Socio-Economic

Nil

* Preliminary Archaeological Study Mackenzie Corridor (Second Report). Jacques Cinq-Mars. July 1974.

D. Miscellaneousd-1 Chamber of Commerce Recommendation

- The Judge advised that the Inquiry staff were studying the ramifications of extending the construction period by one year as had been requested by the NWT Chamber of Commerce. This study would be ready for phase IV.

Vol. 88
13272-13277

Policy and Planning
ACND Division
December 10, 1975.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(Transcript Volumes Nos. 99-101)

Foothills - Phase III - Living EnvironmentYELLOWKNIFE, N.W.T.

December 9 - 11, 1975

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TOPIC: Phase III, The Impact of the Pipeline and Mackenzie Corridor Development on the Living Environment.

Foothills - Living Environment

DATE: December 9, 10 & 11, 1975 in Yellowknife.

WITNESSES: Foothills panel on the Living Environment consisting of:

- L.W. Bouckhout - Manager of Environmental Affairs
Foothills Pipe Lines Ltd.
- N.G. Kondla - Botanist
Lombard North Group Ltd.
- W. Hayden - Aquatic Biologist
Lombard North Group Ltd.
- Dr. G. Finney - Avian Biologist
Lombard North Group Ltd.
- Dr. P.H. Whitney - Mammalogist & Project Manager
Lombard North Group Ltd.

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Technical/Engineering

Nil

B. Environmental

b-1 Impact Assessment - General

- The development of the Environmental Statement, Vol. 99
Environmental Map Series and the biological concerns 15106-15107
were briefly described by Mr. Bouckhout in his 15109-15115
evidence in chief. He also outlined the effects
of the pipeline on the environment, the mitigative
measures and the future environmental work planned.
- The impact of the Foothills pipeline can be kept Vol. 99
within acceptable limits, according to the panel 15135-15169
in cross-examination by ITC/COPE. This conclusion
is based on the assumptions that: (1) the engineers
can build the pipeline as planned, (2) conflicts will
be avoided wherever possible, (3) where conflicts
can't be avoided mitigative measures will be devised
to bring the impact within acceptable limits, (4) the
mitigative measures will work, (5) winter construction
will be used, (6) government agencies will be able
to provide surveillance of the project, (7) applicant
and government inspectors will be able to control the
project and (8) the line wouldn't cross Shallow Bay
or the northern Yukon. The highways were included in
the assessment as far as they are presently completed,
but the prospect of an oil pipeline wasn't formally
addressed. The highway impact would be greater than
that of a pipeline although Dr. Whitney took except-
ion to a previous statement that this impact would
be up to ten times that of a gas pipeline. He
suggested that with proper protective measures a
highway impact could be only slightly more than that
of a pipeline. Reports listing the environmental

TRANSCRIPT
REFERENCE

- consultants' recommendations are in preparation, according to Mr. Bouckhout. Data on the community laterals has been collected recently and is not included in the filed impact statement. The field studies consisted of: (1) reconnaissance, (2) detailed surveys, (3) population studies, and (4) experimental studies with most work to date being of a reconnaissance nature. Areas which require further study are: (1) shore bird migrations, (2) overwintering aspects of fish populations, (3) effects of winter siltation, (4) vegetation on the laterals and between Fort Good Hope and Inuvik and (5) drainage disruption. A multi-disciplinary round table discussion approach was used, not a matrix, because of the subjective nature of environmental decisions.
- Vol. 99
15169-15177
Vol 99
15177-15185
Vol. 100
15203-15208
Vol. 100
15214-15225
Vol. 100
15225-15239
- The environmental report produced to date is a progress report, not an impact report, according to Dr. Whitney in cross-examination by Arctic Gas. The work began in 1974 and presently work is being done on the 1975 field season reports.
 - The panel was asked to comment on the deficiencies of the Arctic Gas application by Commission Counsel. Dr. Whitney said he was reluctant to comment on this forum and pointed out that there will always be some deficiencies. Dr. Hayden said he would like to do more work on (1) winter aquatic ecology and the movement of several species of fish, (2) winter siltation and (3) general data-gathering on the laterals. Mr. Kondla said he would like more information on: (1) the drainage consequences of permanent roads, (2) rare and uncommon vegetation types and, (3) the use of vegetation in evaluating terrain sensitivity and route location. Dr. Finney said he felt there were information gaps in: (1) raptor areas south of Norman Wells, (2) biological variability parameters, (3) the impact of barging on waterfowl and, (4) Native utilization of birds as food. Mr. Bouckhout said Foothills was currently concentrating on developing contingency plans and environmental training programs.

b-2 Routing & Facilities Location

- The effects that biological concerns had on routing and facilities location were briefly outlined by Mr. Bouckhout in his evidence in-chief. The recommendations of the Lombard North Group for route and facilities relocation were filed as an exhibit (appendix to the direct evidence).
 - The crossing in the Holmes Creek area, if moved downstream, would place it in an important swan, waterfowl and beaver area, according to Commission Counsel's cross-examination of Mr. Bouckhout. Dr. Finney added that falcons had been spotted in the area. Commission Counsel pointed out that if moved in the opposite direction the crossing would be in a previously disturbed area. Dr. Whitney said this would lead to drainage problems. The wharf relocations at Thunder River and Payne Creek were moved 14 miles upstream because of denning areas.
- Vol. 99
15107-15109
Vol. 100
15325-15332
Vol. 100
15345-15350

TRANSCRIPT
REFERENCE

The Fort Good Hope re-routing hasn't been established yet.

Vol. 100
15344

- The abandoned CNT cleared right-of-way between Thunder River and Willowlake River had been considered as the pipeline right-of-way but it was felt that it would lead to geotechnical and geotechnically related environmental problems, according to Dr. Whitney and Mr. Bouckhout in cross-examination by Commission Counsel. It should, however, be given serious consideration.

Vol. 100
15332-15343

b-3 Vegetation

- The differences between the Arctic Gas and Foothills applications in respect of vegetation were briefly described by Mr. Kondla in-chief. Foothills would make greater use of native species and use less fertilizer.

Vol. 99
15116-15117

b-4 Fish and Aquatic Ecosystems

- The differences between the two applications with respect to aquatic environments are minor, according to Mr. Hayden in-chief. He outlined the field programs, pointing out that the two areas requiring further work were: (1) the Yellowknife Pine Point laterals and, (2) the aquatic ecology in winter.
- Information required to evaluate a river crossing, according to Mr. Hayden in cross-examination by Commission Counsel, would include: (1) location and season of construction, (2) method and duration of construction, (3) local fish harvest data, (4) river volume and velocity by season and the effect of construction on these characteristics, (5) fish tolerance levels and (6) the winter ecology of fish. The degree of information deficiency varies from river to river. Each river would have to be assessed on an individual basis. Two areas requiring further investigation are: (1) under ice blasting effects, and (2) effects on aquatic invertibrates where streams freeze to the bottom.

Vol. 99
15119-15123

Vol. 100
15285-15297

Vol. 100
15303-15305

b-5 Birds

- The purposes of the avian program were described by Dr. Finney in his evidence in-chief. There are no major differences between the applications where the lines are similar. The areas around Holmes Creek, the Norman Range and Great Bear Rock were singled out as being important raptor sites.
- As the proposed staging area near Axe Point is an important waterfowl area, the engineers have said they would boom off areas used for fuel transshipment, according to Dr. Finney in cross-examination by ITC/COPE. Of the avian-related recommendations made, 75% are still awaiting approval.
- Sightings of whooping cranes on the Yellowknife - Pine Point lateral weren't known to Lombard North, according to Dr. Finney in cross-examination by Commission Counsel. This would be investigated.
- The gas scrubbing plant at Taglu, as proposed by the Producers, would be within the Kendall Island Bird Sanctuary but can only be built there with the permission of the Canadian Wildlife Service (CWS), according to cross-examination of Dr. Finney by Commission Counsel. If located 8 miles south-east it would be on higher ground and outside the sanctuary but this is a decision for the Producers.

Vol. 99
15125-15128
Vol. 100
15373

Vol. 100
15195-15203

Vol. 100
15369-15370

Vol. 100
15318
Vol. 101
15402
Vol. 100
15319-15325

b-6 Mammals

- The summer's mammal field program and the mammalogists' interaction with geotechnicians were described by Dr. Whitney in his prepared evidence. He said outstanding concerns were related to the impact of the Pine Point - Yellowknife lateral on woodland caribou, wood bison and aquatic furbearers. In cross-examination by Commission Counsel, Dr. Whitney said he was not yet in a position to make an impact prediction in that area but most of the risk seemed to be in habitat destruction. Vol. 99
15128-15132
- The data on woodland caribou is scattered through a number of reports and publications and needs to be pulled together into one volume, according to Dr. Whitney in cross-examination by ITC/COPE. Vol. 99
15139-15142
- The distribution and abundance of the Bluenose Caribou Herd isn't well known, according to Dr. Whitney in cross-examination by Commission Counsel. The possibility of a pipeline or highway project deflecting the herd so that it might absorb the reindeer herd is a problem worthy of investigation. The Woodland Caribou exist along the pipeline from Travaillant Lake south and their possible interaction with the pipeline is under study. Vol. 100
15208-15214
15352-15366
- The "edge effect" of the pipeline right-of-way and the effect on moose will be considered, according to Dr. Whitney in cross-examination by Commission Counsel. Vol. 100
15374-15376

b-7 Game Management

- Foothills would co-operate with the appropriate agencies in developing game management plans, according to Mr. Bouckhout in cross-examination by ITC/COPE and Commission Counsel. Vol. 100
15242-15244
15247-15250
15377-15380

b-8 Toxic Substances and Siltation

- A list of toxic substances to be used on the project was requested by ITC/COPE. Vol. 100
15186-15188
- Winter siltation studies will be designed to make general predictions such as distance of travel, under ice effect on dissolved oxygen etc., according to Mr. Hayden in cross-examination by Commission Counsel. Vol. 100
15297-15300
- The possibility of experiments on methanol and other toxic substances is being considered in light of the recent work by Aquatic Environments. Vol. 100
15300-15303

b-9 Disturbance Effects

- The Foothills construction schedule is such that it will avoid disturbing moose movements into their wintering areas on the Mackenzie, according to Mr. Bouckhout in cross-examination by the NWT Indian Brotherhood/Métis Association. Vol. 99
15133-15135
- Aircraft flights should be kept above 2,000 feet to avoid disturbing birds, according to Dr. Finney in cross-examination by ITC/COPE. Flight path restrictions would also be desirable. Similar restrictions would be enforced from a mammal viewpoint, according to Dr. Whitney. No discussions have been held with MOT on this subject. Vol. 100
15261-15270
15374

b-10 Borrow Sources

- Islands and bars in the Mackenzie River won't be used as borrow sources, according to Dr. Whitney and Mr. Bouckhout in cross-examination by Commission Counsel. Commission Counsel suggested that the borrow site at Trout River (MP749) seemed to contradict the statement that borrow sites wouldn't be located on active flood plains.

Vol. 100
15343-15344

 Vol. 100
15350-15351

b-11 Monitoring and Environmental Education

- A critical path plan for environmental input through to the operation and maintenance stage will be developed, according to Mr. Bouckhout in cross-examination by ITC/COPE. The organization of inspection staff was briefly outlined. The key will be in obtaining well rounded people. The environmental manual will be designed for inspectors and supervisory staff. The training program is presently being developed.

Vol. 100
15188-15191

 Vol. 100
15250-15258
- A detailed account of the ambit and scope of the Foothills monitoring program was requested by Commission Counsel. Mr. Bouckhout said it was not fully developed.

Vol. 100
15370-15373

C. Socio-Economic

Nil

D. Miscellaneous

- The Inquiry participants congratulated the court reporters on reaching volume 100 of the formal hearing transcripts!

Vol. 100
15318-A

Policy and Planning (ACND)
Division,
January 8, 1976.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(Transcript Volumes Nos. 101 and 102)

Phase II

CARC - Impact on the Physical Environment

YELLOWKNIFE, N.W.T.

December 11 and 12, 1975

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TOPIC: Phase II: Impact of the Pipeline and Mackenzie Corridor Development on the Physical Environment.

CARC: Impact on the Physical Environment

DATE: December 11 & 12, 1975 in Yellowknife.

WITNESSES: CARC's panel consisting of:

Dr. E.B. Peterson: President, Western Ecological Services Ltd., (Previously Project Manager, Northern Pipeline Study, Environment Canada).

Mr. S.C. Zoltai: Research Scientist, Environment Canada.

HIGHLIGHTS:

TRANSCRIPT
REFERENCE

A. Technical/Engineering

Nil.

B. Environmental

b-1 Pipeline Guidelines and Environmental
Social Program

- The terms of reference for the Environmental-Social Program (E-SP) and the scope of the E-SP studies were described by Dr. Peterson. Vol. 101
15409-15420
- The purpose of the 1972 Pipeline Guidelines was to expand on guideline #6 of the 1970 guidelines and thereby indicate some of the major topics to be included in an environmental assessment, according to Dr. Peterson. The guidelines were not to be considered as environmental protection requirements. Vol. 101
15422-15426
- The E-SP studies were confined to the gas trunk pipeline, according to Dr. Peterson in cross-examination by ITC/COPE. He said he didn't know why the gas process plants, etc., were excluded. Some assumptions in preparing the Guidelines were: (1) a pipeline would be used and not other modes of transporting oil and gas, (2) some throughput would come from the Delta region and, (3) some throughput would come from Alaska. The Guidelines were a 'checklist' for the applicant but the relevant Acts, Ordinances etc., would govern the project. None of the E-SP work looked into the applicability of the legislation. New legislation isn't necessarily required for this pipeline. Most people in government feel there is adequate existing legislation to regulate it from an environmental standpoint. The administrative implementation could be simplified. This was not studied as part of the E-SP. The authority administering the Acts should have two objectives: (1) it should be capable of decisive action without a long chain of command and (2) it should have the right type of back-up expertise. The applicants' statements must be compared to what the regulatory officials have in mind. The Guidelines are not meaningful in this regard, but legislation such as the Migratory Birds Act, Territorial Lands Act etc. are. Vol. 102
15547-15552
Vol. 102
15568-15576
Vol. 102
15576-15579

b-2 Corridor and Routing

- No route was ever specified by Government, according to Dr. Peterson. The E-SP study areas were generally determined by the route maps supplied by the pipeline consortia. Vol. 101
15420-15422
- The Corridor, as described in the Guidelines, would not include the East of Franklins route, according to Dr. Peterson in cross-examination by Arctic Gas. The cross Delta route wasn't contemplated when describing the corridor, otherwise it would have been included. The Judge pointed out that the Guidelines had no statutory authority and the pertinent Acts still applied. In cross-examination by ITC/COPE, Dr. Peterson said that the corridor concept was accepted as a given from the 1970 guidelines and no E-S Committee work was aimed at evaluating the concept. The issue was debated within Environment Canada and the conclusion was reached that the concept could only be evaluated by experiment - it couldn't be decided by a study. Therefore, the first applicant was asked to evaluate their route for a second project. Vol. 101
15506-15516
- The best route in the Ebbutt Hills area from a terrain viewpoint would be the Arctic Gas amended route to Willowlake River and from there a route curving to the west to avoid the Ebbutt Hills and crossing the Mackenzie upstream of Fort Simpson, according to Mr. Zoltai. Vol. 101
15466-15468
Vol. 102
15500-15502
15539-15542
- The abandoned CNT line should be a good site for pipeline construction if the steep parts which show erosion are avoided, according to Mr. Zoltai in cross-examination by Commission Counsel. In cross-examination by Foothills it was suggested that drainage problems on the CNT line could lead to pipeline problems. Vol. 101
15528-15530
Vol. 102
15543-15545
- The interior route would be best from a terrain viewpoint, according to Mr. Zoltai in-chief. In cross-examination by Commission Counsel, Mr. Zoltai said that the cross Delta route would be hazardous. Vol. 101
15469
Vol. 101
15521-15522
- The areas to be avoided, according to Mr. Zoltai, are: (1) sensitive areas as defined in E-SP report 73-4, (2) areas of high ground water activity, such as: (a) MP380-400 between the Richardson Mountains and the Mackenzie Delta, (b) the western flank of the Franklins north of Willowlake River, (c) MP450-470 on the eastern flank of the Richardsons on the Interior Route and (d) MP195-290 on the Yukon Coastal Plain. Vol. 101
15462-15465

b-3 International Biological Program (IBP) and other
Special Sites

- No restricted or excluded areas as outlined by Guideline #4 have been officially designated, according to Dr. Peterson in-chief. The E-SP reports identify some such areas and the E-SP recommended that the Campbell Lake area near Inuvik be an excluded area. The suggested areas for restrictions are: (1) wildlife areas along the Kakisa River west of Tathlina Lake, (2) highly sensitive areas such as segments of the Hare Indian, Willowlake, Travaillant, Harris, Jean Marie, Trout, Great Bear and Old Crow Rivers, (3) streams identified Vol. 101
15426-15435

- The International Biological Program was described by Dr. Peterson and he indicated how IBP ecological reserves relate to the proposed pipeline project. It was recommended that: (1) both applicants establish sites for long-term research and monitoring areas, (2) the Willowlake (Brackett Lake) site be established with particular emphasis placed on monitoring the southeast portion of the site, (3) the Caribou Hills site be established with monitoring emphasis on the Devil Creek Watershed and (4) the Dolomite Lake-Campbell Lake site be established with no monitoring. In cross-examination by ITC/COPE, Dr. Peterson pointed out that the proposed IBP sites at the Firth River and Old Crow flats were not compatible with the pipeline. Lacking direction from Government, the applicant wouldn't know if the sites should be avoided. If both areas were set aside the routing of a pipeline would be difficult. The sites do not exclude native use of the area since man is assumed to be part of the ecosystem. In cross-examination by Commission Counsel, Dr. Peterson said only 7 out of 140 IBP sites have been formally applied for: thirteen are along the pipeline route and only three of these are formally proposed. The Inquiry might benefit from the preparation of the balance. The three proposed are (1) Dolomite-Campbell Lake, (2) Caribou Hills and (3) Brackett Lake. Four proposed sites which directly contact the Arctic Gas route are the Rat River site, the Ebbutt Hills site, the Old Crow Basin and the Firth River sites. The latter two are recommended for outright avoidance and will be formally submitted within six months.

- Two monitoring sites, such as Arctic Gas' Chick Lake site, should be established - one in continuous and one in discontinuous permafrost areas, according to Dr. Peterson in cross-examination by Commission Counsel and Foothills. The applicants should be invited to propose their own sites.

- The frost heaving of a chilled gas pipeline in unfrozen fens wouldn't be prevented by the techniques described by the applicant, according to Mr. Zoltai in-chief. The pipeline should avoid contact with unfrozen fens. In cross-examination by Arctic Gas and Commission Counsel, Mr. Zoltai explained that the surcharge berm would sink into the fen. Arctic Gas pointed out that roads and railroad fill had been successfully placed across fens. Ponding should be avoided or thermokarst conditions could develop, according to Mr. Zoltai. About 5 to 10 percent of the route in the discontinuous permafrost zone would be in fen lands. Arctic Gas disputed this and asked Mr. Zoltai to examine their figures and comment through counsel.

Vol. 101
15455-15457

Vol. 101
15480-15500
15517-15518

- The formation of pulsas and their effect on a pipeline were described by Mr. Zoltai in-chief. Vol. 101
15453-15455
In cross-examination by Arctic Gas and Commission Counsel, Mr. Zoltai said field experiments should be conducted in wet fenlands. 15502-15505
15521

b-5 Vegetation

- Experiments are needed to devise an effective re-vegetation program, according to Mr. Zoltai in-chief. Vol. 101
15469-15471
Agronomics and native species that invade disturbed areas have low insulative qualities. In cross-examination by Arctic Gas and Commission Counsel, Mr. Zoltai said that the revegetation program as proposed is for water erosion protection not thermal erosion protection. Thermal protection can only be obtained in the short-term by artificial means in combination with revegetation. 15473-15474
15519-15520
- The Producers' plans to cut 8,000 piles in the Fort McPherson area is of some concern because of the long time it takes for new growth, according to Mr. Zoltai in cross-examination by ITC/COPE. Vol. 102
15583-15585

b-6 Fires

- Fires are of concern because of the permafrost degradation effect, according to Mr. Zoltai in-chief. Vol. 101
15468-15469
The applicant should be required to have contingency plans for fire prevention, detection and control. In cross-examination by Arctic Gas Mr. Zoltai said he didn't know if such plans were required on the highway. Vol. 101
15506
In cross-examination by Commission Counsel, Mr. Zoltai said that from a terrain viewpoint construction in formerly burnt, non-sloping areas was preferred. Vol. 101
15526-15528

b-7 Water and Drainage

- Water for construction purposes on the North Slope would be a problem, according to Mr. Zoltai in cross-examination by Arctic Gas. Vol. 101
15478-15480
- The ground water chilled pipeline interaction requires further investigation, according to Mr. Zoltai in cross-examination by Arctic Gas. In cross-examination by Commission Counsel and Foothills, Mr. Zoltai identified the western flanks of the Franklins, particularly around the Willowlake River crossing, as potentially difficult locations. The flanks of the mountains in the Norman Wells area are also areas of concern. Vol. 101
15475-15478
Vol. 101
15525-15526
15535-15539

b-8 Miscellaneous

- Mr. Zoltai described the terrain studies done in the Mackenzie Valley and Yukon and described how permafrost, terrain and vegetation disturbance are inter-related. He recommended that no structure be installed that would disrupt the natural drainage and cause prolonged ponding. The research that is required to limit terrain damage is: (1) ground water - chilled pipeline interaction, (2) prevention of artificial pulsas in wet fens and (3) revegetation program development effective in both thermal and hydrological erosion. Vol. 101
15447-15452
Vol. 101
15471-15472
- Mr. Zoltai said he agreed with all the recommendations in E-SP report volume 73-4. Vol. 101
15530-15533
Vol. 102
15543

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUME NO. 102)

CARC - PHASE III - LIVING ENVIRONMENT
 RARE AND ENDANGERED SPECIES
YELLOWKNIFE, N.W.T.

DECEMBER 12, 1975TABLE OF CONTENTS

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TOPIC: Phase III: Impact of the Proposed Pipeline and Mackenzie Corridor Development on the Living Environment

CARC: Rare and Endangered Species

DATE: December 12, 1975 in Yellowknife.

WITNESS: CARC's witness on Rare and Endangered

Species:

Dr. N.S. Novakowski: Co-ordinator Wildlife Management Branch, Canadian Wildlife Service, Ottawa.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

- nil

B. Environmental

b-1 General - Rare and Endangered Species

- The pipeline construction will require special regulations relating to the protection of wildlife because the Territorial Land Use Regulations don't specifically relate to wildlife, according to Dr. Novakowski in his evidence in chief. The Territorial Game Regulations, DOE and Migratory Wildfowl Regulations and international agreements such as the Polar Bear Agreement and the Convention on International Trade in Endangered Species of Wild Fauna and Flora, would apply. Vol. 102
15615-15617
- Dr. Novakowski provided a definition of rare and endangered species and listed the species designated in the Convention for International Trade in Endangered Species. These species are not defined or listed by the Territorial Governments. A rare and endangered species policy is under discussion. Dr. Novakowski recommended that: (1) the protection of such species in the Territories be transferred to a Federal-Territorial joint committee using the Canada Wildlife Act as a means of protection and, (2) if development goes into a rare and endangered species area the developer should be responsible for assisting in rehabilitation. Vol. 102
15618-15632
15633
- Vol. 102
15655-15659

b-2 Game Management

- Three steps need to be taken on fur management, according to Dr. Novakowski. They are: (1) the Territorial Governments need encouragement to increase incentives to increase utilization of fur bearers, (2) fur trapping areas assigned to an individual trapper should be delineated to give him pre-eminent rights to that resource and, (3) transplants of aquatic fur bearers should not be counted on in rehabilitating a resource. In response to the Judges' question, Dr. Novakowski explained why the fur bearers in the Territories are underharvested. Vol. 102
15624-15626
- Vol. 102
15626-15629

b-2 Game Management (Cont'd)TRANSCRIPT
REFERENCE

- Game management plans should have been developed years ago and should have been incorporated in the preplanning of a pipeline corridor, according to Dr. Novakowski in cross-examination by ITC/COPE, Foothills and Commission Counsel. The regulation gaps in an ecosystems approach to wildlife should be filled in for this project by the Inquiry. Territorial Government Game officials could supply this type of recommendation. Vol. 102
15660-15661
15674-15697
15698
- The lack of wildlife planning in corridor planning is the fault of both the government and the pipeline companies, according to Dr. Novakowski in cross-examination by Arctic Gas. The alignment followed terrain criteria without considering the biological aspects. In cross-examination by Foothills, Dr. Novakowski agreed that the proposed pipelines could be built with the qualifications mentioned in his testimony. Vol. 102
15690-15692
Vol. 102
15661-15663

b-3 IBP Sites

- The IBP Sites were identified by Dr. Novakowski with maps and charts, and CARC's Counsel filed as exhibits the three formal applications to the Minister for the IBP Sites at Willow Lake, Dolomite-Campbell Lakes and Caribou Hills. Vol. 102
15651-15679
- The Campbell Lake area is being considered as a reserve under the Canada Wildlife Act, according to Dr. Novakowski in cross-examination by Foothills. In cross-examination by Arctic Gas, Dr. Novakowski pointed out that both applicants' projects infringed on this area. In re-examination by CARC, it was pointed out that a similar situation existed with respect to the Willow Lake site. Vol. 102
15664-15665
Vol. 102
15689-15690
Vol. 102
15705-15707
- The Campbell Lake site is the first priority, followed by the Caribou Hills and Cirque Lake sites respectively, according to Dr. Novakowski in cross-examination by ITC/COPE. Vol. 102
15685-15689

b-4 Terrestrial Speciesb4-1 Fox

- Habitat and denning areas are key factors for foxes, according to Dr. Novakowski in cross-examination by ITC/COPE. The effects of seismic activity are important on a local scale. Vol. 102
15619-15665
15671

b4-2 Marten

- The marten are vulnerable to trapping pressure, and the populations in the Anderson River and upstream along the Mackenzie would be at some risk from pipeline development, according to Dr. Novakowski in chief and in cross-examination by ITC/COPE. Vol. 102
15621-15671

b4-3 Grizzly Bear

- Pipeline conflict with grizzly bear would be by chance or due to attractants (garbage), according to Dr. Novakowski. In cross-examination by ITC/COPE Dr. Novakowski explained that the bears have been harassed in the Richards Island area but have survived. The gas plants in the area will be of concern. It is not endangered species but international co-operation exists to help in management. Vol. 102
15630-15632
15709-15710
15675-15678
15679-15682

TRANSCRIPT
REFERENCEb4-4 Fisher and Lynx

- The fisher is not as abundant in the Territories as in the northern parts of the provinces, according to Dr. Novakowski in-chief and in cross-examination by Arctic Gas. Vol. 102
15618-15692
15693
- The lynx has a cyclical population and is becoming more popular for its fur, according to Dr. Novakowski. Vol. 102
15620

b-5 Aquatic Speciesb5-1 Beaver

- The beaver is less susceptible to human disruption because of its pioneering character, according to Dr. Novakowski. It is susceptible to oil spills, however. Vol. 102
15622-15623
15671-15674

b5-2 Muskrat

- The high populations of muskrat in the Delta are vulnerable to disruption, according to Dr. Novakowski. In cross-examination by Commission Counsel Dr. Novakowski agreed that the muskrat was more important than might be assumed from its position in the ranking of furs because of its distribution, guaranteed nature of income for trappers, etc. Vol. 102
15623
Vol. 102
15700-15705

b-6 Conflicts with Rare and Endangered Speciesb6-1 Peregrine Falcon

- The peregrine falcon never was numerous according to Dr. Novakowski. Present population estimates are about 100 birds. They must maintain their breeding habitats to survive outside North America. There are less than 12 pairs in Sweden. Vol. 102
15633-15637
15653-15654
15707-15708

b6-2 Eskimo Curlew

- The Eskimo curlew may be extinct although there have been some unconfirmed sightings in the Delta area, according to Dr. Novakowski. Northern oil and gas activities are in the suspected nesting areas. Vol. 102
15637-15638
15708-15709

b6-3 Whooping Crane

- The whooping crane is a rare and endangered species of which only 50 wild and 20 captive birds survive, according to Dr. Novakowski. The only known nesting site is in Wood Buffalo National Park. The recent hatching success rates and "fostering" programs were described. Vol. 102
15638-15644
15710-15711

b6-4 Wood Bison

- Wood Bison are now rare with only about 200 animals left in Canada, of which about 130 are in the Mackenzie Bison Sanctuary, according to Dr. Novakowski. The East of Franklins Route could interfere with a future range. In cross-examination by Foothills, Dr. Novakowski said the Yellowknife lateral wouldn't cut off a very important part of the Mackenzie Bison Sanctuary if the bison population didn't expand. Vol. 102
15644-15645
Vol. 102
15663-15664

b6-5 Wolverine

- The wolverine isn't abundant, is nocturnal and very wary of man, according to Dr. Novakowski. There is poor data on its numbers and distribution. Human activities will probably have a minimum impact on wolverine. Vol. 102
15621-15622
15645-15647
15693-15694

b6-6 Grey WolfTRANSCRIPT
REFERENCE

- The grey wolf is threatened but is still subject to bounty, according to Dr. Novakowski. Vol. 102
Hunting by unlicensed hunters should be prohibited. 15648-15649
ITC/COPE pointed out that the bounty had been Vol. 102
removed in March 1975. 15682-15684
15694-15696

b6-7 Polar Bear

- Polar Bear is hunted by Inuit only and there should be few contacts with pipeline work, according to Vol. 102
Dr. Novakowski. In cross-examination by ITC/COPE, 15649-15651
Dr. Novakowski pointed out Canada's international Vol. 102
obligations in protecting the bears. 15685

Policy and Planning
ACND Division
January 13, 1975.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(Transcript Volumes Nos. 103-105)

CARC - Phase III - Living Environment
FISHYellowknife, N.W.T.

December 15 - 17, 1975

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TOPIC: Phase III: Impact of the Proposed Pipeline and Mackenzie Corridor Development on the Living Environment.

CARC - FISH

DATE: December 15, 16 and 17 in Yellowknife.

WITNESSES: CARC's panel on fish consisting of:

- Mr. J.N. Stein: Acting Head, Environmental Impact Assessment Division, Fisheries and Marine Service, Environment Canada, Winnipeg.
- Mr. C.E. Walker: Senior Biologist, Fisheries and Marine Service, Environment Canada, Vancouver.
- Mr. L.W. Steigenberger: Fish and Wildlife Branch, University of British Columbia.
- Mr. J.M. Millen: Senior Engineer, Environmental Protection Service, Environment Canada, Vancouver.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

Nil.

B. Environmental

b-1 Impact and Information Gaps

- The work done by the Fisheries and Marine Service in the Mackenzie Valley and Northern Yukon was outlined by Mr. Stein and Mr. Walker. They pointed out that all their pipeline recommendations were highly conservative since there is insufficient information to ensure protection of all fish. The areas requiring more work were described by Mr. Stein and Mr. Steigenberger. Vol. 103
15720-15723
Vol. 103
15743-15747
- Most of the additional work required is in the collection of data on major species and identification of critical habitats, according to Mr. Stein in cross-examination by Arctic Gas. A lot of this type of work is being done as design review of the Mackenzie Highway. With that data, and if all the guidelines are followed, the short-term impact should be controllable. Vol. 103
15740-15743
15782-15788
Vol. 103
15800-15809
- Additional studies which need to be done before a pipeline is built would take two to three years, according to Mr. Stein in answer to the Judge's questions. In cross-examination by ITC/COPE and Commission Counsel, Mr. Stein said that the areas requiring study included: (1) winter habitats, (2) sedimentation, (3) toxicity, (4) fish response to dredging, (5) effects of instream construction berms and (6) water sources. Mr. Steigenberger outlined the species on which further information is required in the northern Yukon, pointing out that understanding the winter biology was of prime importance. No work has been done since Vol. 104
15867-15878
Vol. 105
16074-16086

b-1 Impact and Information Gaps Cont'd.TRANSCRIPT
REFERENCE

March 1975 when the ES program was disbanded and this means that the Fisheries Service is falling behind. Mr. Millen said two areas required work: (1) erosion control, and (2) subsurface water-frost bulb interactions. Mr. Walker agreed, in cross-examination by ITC/COPE, with Dr. McCart, who said the pipeline could be built without adverse effect to aquatic ecosystems. The Judge pointed out that this appeared to conflict with the panel's earlier testimony. Mr. Walker explained that in one to three years (after further work) a single pipeline could be built in the winter. After outlining the study objectives of the past four year's work and the success in meeting those objectives, Mr. Stein and Mr. Walker said that they were not in a position to do an impact assessment. However, if the guidelines and recommendations outlined in the panel's testimony were implemented, they would be in a position to make an assessment. Additional habitat data is required. Mr. Walker and Mr. Steigenberger pointed out that the environmental work done by Arctic Gas was without precedent.

Vol. 104
15912-15925

Vol. 104
15841-15864
Vol. 105
16001-16005
16006-16016

b-2 Corridor and Routing

- A comparison of the prime, interior, Fort Yukon and Fairbanks routes from a fisheries viewpoint was presented by Mr. Walker in his evidence-in-chief. He concluded that the Fairbanks route was superior to the prime route but the prime route was preferable to the interior route. Mr. Steigenberger agreed with the selection of the prime over the interior route.

Vol. 103
15747-15754
- The selection of the prime route over the interior route and the advantages of the Fairbanks route were explained by Mr. Walker and Mr. Steigenberger in cross-examination by ITC/COPE. The cross delta routing was not included in the assessment.

Vol. 103
15773-15775
Vol. 105
15976-15978
- The Fairbanks route would be best if only Prudhoe Bay gas were to be delivered, otherwise the prime route is best, according to Mr. Walker in cross-examination by Arctic Gas.

Vol. 104
15904-15912
- The East of Franklins route appears attractive because of the availability of granular material and the fewer river crossings, according to Mr. Stein. In cross-examination by Arctic Gas and Foothills, he said there was no fisheries' information for the area and the need for all-weather access roads wasn't considered. In cross-examination by the NWT Indian Brotherhood/Métis Association, Mr. Stein agreed that there could be socio-economic factors that would make the area unsuitable.

Vol. 103
15739-15740
- The corridor concept is impossible to relate to from a fisheries viewpoint, according to Mr. Steigenberger in-chief. A watershed concept must be emphasized. In cross-examination by Arctic Gas, Mr. Steigenberger and Mr. Stein agreed that the reach of a river to be considered must be related to the nature of the development proposed.

Vol. 103
15759-15760

Vol. 105
16046-16051

TRANSCRIPT
REFERENCE

b-2 Corridor and Routing Cont'd.

- The corridor concept was investigated but there is no report or paper on the topic, according to Mr. Millen in cross-examination by Arctic Gas. Vol. 105
16066-16067

b-3 Fisheries

- The utilization of northern fish resources and the fishery surveys were described by Messrs. Stein and Steigenberger in-chief. Vol. 103
15730-15731
- Controls on fishing by pipeline personnel should be enforced as much as possible by the applicant, but it may be necessary to change the fishing regulations, according to Mr. Stein in cross-examination by Foothills. 15755-15758
Vol. 105
15988-15991
- The cumulative effect of natural and man-made impacts on fish resources is not known, according to Mr. Stein in cross-examination by ITC/COPE. Mr. Stein explained why he disagreed with Dr. McCart's statement that it is more important to know population sizes than feeding habits. Mr. Walker pointed out that most fish appear to be opportunists in their food habits. Mr. Stein said that restocking of fish was subject to too many unknowns to be considered viable. The report on the domestic fisheries in the northern Yukon was explained for ITC/COPE and Arctic Gas by Mr. Steigenberger. Mr. Stein explained that the fisheries resource may increase in value as development of the Mackenzie Valley continues. Vol. 104
15864-15866
- The domestic utilization of char in the Big Fish River is threatening population stability, according to Arctic Gas in cross-examination of Mr. Stein. The possibility of conflicts between domestic, commercial and sport fisheries will require changes in legislation according to Mr. Walker and Mr. Stein. Vol. 104
15939-15952
Vol. 105
16064-16065
- The use of Yukon coastal lagoons by Mackenzie River fish is a subject requiring further study, according to Mr. Steigenberger in cross-examination by ITC/COPE. Vol. 103
15820-15823
Vol. 105
16086-16091
- The use of Yukon coastal lagoons by Mackenzie River fish is a subject requiring further study, according to Mr. Steigenberger in cross-examination by ITC/COPE. Vol. 104
15879-15880

b-4 Critical and Sensitive Areas

- The critical times during which in-stream work should be avoided are September 1 to November 15 and May 1 to July 15, according to Mr. Stein in-chief. Mr. Stein described the reports that outline sensitive areas and listed some of the more important locations. He pointed out that the mouths of all rivers are utilized by fish and therefore should be avoided by pipeline facilities and crossings. Vol. 103
15732-15737
- Critical areas, according to Mr. Steigenberger in-chief, include:
 (1) areas known or acceptable for fish utilization, (2) areas of heavy fish concentration, and (3) potential or established over-wintering areas. The sensitive/critical areas on the prime and interior routes were described. Vol. 103
15760-15773
- The recommendations made by the Fisheries Service on all the Mackenzie Highway Vol. 105
16027-16030

b-4 Critical and Sensitive Areas Cont'd.TRANSCRIPT
REFERENCE

- crossings would have to be obtained from the Mackenzie Highway Working Group, according to Mr. Stein in cross-examination by Arctic Gas.
- The criteria for designating an area as critical are the presence of fish in any life-stage and the potential utilization of an area by any life-stage, according to Mr. Steigenberger in cross-examination by ITC/COPE. This is a conservative designation. Vol. 104
15889-15896
 - Critical habitats are those that, if lost to the resource, would have a severe repercussion on the population, according to Mr. Stein in cross-examination by Foothills. Vol. 105
15983-15984
 - If information on a stream is deficient, it should be assumed to be an important fish habitat which would be affected by a pipeline. The regulatory agency should assemble all industry and government information on streams. Vol. 105
16091-16099
 - Stream flows vary weekly on some streams such as the Ochre, according to Mr. Millen in cross-examination by Arctic Gas, and this should be considered in the design of crossings. Sensitive areas described by Mr. Stein in cross-examination are: Vol. 103
15810-15813
Vol. 103
15824-15827
 - (1) the Swan Lake Creek System, (2) the Three Day Lake System, (3) the Rabbit Skin, Liard and Martin Rivers (which aren't crossed by the pipeline) and (4) the mouth of the Arctic Red River.

b-5 River Crossings

- The choice of stream-crossing techniques must ultimately be made on site, according to Mr. Stein in-chief. The danger of sedimentation is equally applicable to small flow streams designated as 'minor' by the applicant, since such streams may be critical for egg incubation or over-wintering. The criteria for culvert design at a stream crossing were described. Vol. 103
15723-15725
Vol. 103
15731-15732
16069-16070
- Arctic Gas should indicate which of the standard designs would be used at the smaller stream crossings. Data on areas downstream of a pipeline crossing which contain eggs of fall spawning species are probably lacking. Vol. 103
15809-15810
- Streams between the Willowlake River and Great Bear River have been observed to be open in November when Arctic Gas plans to begin work but this wouldn't be a problem with Foothills later start-up date, according to Mr. Millen in cross-examination by Foothills. Vol. 105
15995-15996
- The eight items to be addressed at minor stream crossings were described by Mr. Millen in-chief. In cross-examination by Commission Counsel, Mr. Stein said three items need to be known for all crossings: Vol. 103
15791-15794
Vol. 105
16099-16102
 - (1) the fish species utilizing a stream and their abundance, (2) an analysis of habitat at and below a crossing and (3) a sediment impact assessment. For summer crossings the three areas to be documented are: (1) fish

TRANSCRIPT
REFERENCE

b-5 River Crossings Cont'd.

migration routes and times, (2) fish reactions to dredging and (3) the effect of berms in streams. For winter crossings with flow, the areas of interest are:
(1) flow rates and patterns, (2) sedimentation extent and effects, and (3) water chemistry such as dissolved oxygen.

b-6 Spawning and Over-wintering Areas

- Although there is a deficiency of site specific information, it is known that cisco and whitefish utilize small streams, according to Mr. Stein in cross-examination by Arctic Gas. Vol. 103
15817-15820
Vol.
15901-15903
- There may be some critical over-wintering areas on the North Slope downstream of a pipeline crossing that have not been identified by Dr. McCart, according to Mr. Steigenberger and Mr. Stein in cross-examination by Arctic Gas. Potential and suspected areas should be protected. The spawning areas on the Firth and Fishing Branch Rivers were described. Vol. 105
16033-16036
16051-16058
- The crossing of Shallow Bay is of some concern, according to Mr. Stein in cross-examination by ITC/COPE. Work would be underway during the periods of major fish migrations through the area. Their reactions to dredging are unknown. The migration times vary but start as early as late July with return migrations lasting into late November. It is critical to ensure passage through the area. Vol. 105
16044-16046
Vol. 104
15896-15900
15903-15904

b-7 Sedimentation

- It isn't possible to say how far downstream sedimentation effects can be felt, according to Mr. Stein in cross-examination by Arctic Gas. The Arctic Gas sponsored work on sedimentation in Miner Creek was described. Mr. Stein said some similar work was being done by the Freshwater Fisheries Institute. He wasn't aware of Dr. McCart's work with the Inland Gas Co. in southern B.C. Vol. 104
15837-15839
Vol. 105
16024-16027

b-8 Granular Material

- The use of active flood plains as sources for granular materials has serious environmental consequences, according to Mr. Stein-in-chief. It should be avoided wherever possible and, like the highway, borrow sources should be kept 300 feet away from active channels. The five rules and information required if an active flood plain were used for gravel borrow were described. Mr. Steigenberger pointed out that gravel is necessary to the life cycle of fish. He gave four recommendations for gravel removal procedures. Vol. 103
15726-15728
- The 300-foot buffer between a gravel operation and an active channel is a general guideline developed for the Mackenzie Highway, according to Mr. Stein and Mr. Millen in cross-examination by Vol. 103
15813-15815
Vol. 105
15984-15988
16070-16072

b-8 Granular Material Cont'd.TRANSCRIPT
REFERENCE

Arctic Gas and Foothills. The final decision would be made by a Fisheries officer. Mr. Steigenberger pointed out 300 feet may not be adequate in all cases. It would be preferable if no gravel was extracted below the design flood high water stage.

- The reasons for different regulations on gravel removal in the Yukon and N.W.T. were described by Messrs. Walker and Millen in cross-examination by Commission Counsel. Vol. 103
16102-16108

b-9 Water Use

- Water extraction from lakes could cause a drawdown resulting in a loss of habitat, according to Mr. Stein, but the withdrawal from rivers is potentially more serious. The four water withdrawal criteria that must be satisfied by the applicants on a site specific basis were described. Vol. 103
15728-15730
15780-15782
- The Mackenzie River would be used as a water source wherever possible, according to Arctic Gas in cross-examination of Mr. Stein. Mr. Steigenberger said he didn't entirely agree with Arctic Gas on the availability of water on the North Slope. Water should only be taken from lakes on the North Slope. Vol. 103
15815-15817
Vol. 105
15997-16000
16036-16044

b-10 Methanol and Toxic Substances

- The use of methanol can't be recommended from a fisheries viewpoint, according to Mr. Stein in-chief. Mr. Steigenberger outlined the recommendations for toxic spills and described his general concerns with an oil pipeline. Vol. 103
15737-15739
Vol. 103
15771-15775
- A one per cent solution of methanol wouldn't be highly toxic to fish, Mr. Stein agreed in cross-examination by Arctic Gas. He suggested that further studies be done. Vol. 103
15827-15830
- The re-use of a methanol solution could lead to it picking up contaminants which would change its properties from those in the tests done by Dr. McCart, according to Mr. Millen in cross-examination by ITC/COPE. The solution should be tested for such contaminants before disposal. Disposal on land would be preferred from a fisheries viewpoint. Vol. 104
15952-15965

b-11 Location of Facilities

- Wharf sites and staging areas shouldn't be located at river mouths, according to Mr. Millen in-chief and in cross-examination by Arctic Gas and Foothills. The highway guideline of keeping 1500 feet away from a river mouth should also apply to a pipeline. Establishment of the sites would set a precedent for future use even if the facility were dismantled. Vol. 103
15789-15791
Vol. 104
15965-15966
Vol. 105
15992-15995
- An all-weather road along the pipeline would be an asset in getting to the scene of a spill, according to Mr. Walker in response to the Judge's question. In cross-examination by ITC/COPE, Mr. Walker said a Vol. 105
15978-15981
Vol. 104
15968-15970

TRANSCRIPT
REFERENCE

b-11 Location of Facilities Cont'd.

permanent road would be a concern but proper regulations and enforcement could take care of additional fish resource utilization.

b-12 Surveillance and Monitoring

- The Inquiry stipulations for the project must allow for some site specific variations, according to Mr. Millen-in-chief. The Fisheries Act applies to all fish-not just "significant" fish populations. The Act doesn't require the review of designs, etc. Vol. 103
15794-15798
- Plans for three monitoring sites at highway river crossings were described by Mr. Millen and Mr. Stein in cross-examination by ITC/COPE. The need for a regulatory system to take care of preconstruction, construction, operations and maintenance, abandonment and ancillary development was outlined by Mr. Walker using his experience on the Aishihik Lake hydro project as an example. Vol. 104
15933-15937
- The Fisheries Service could have an effective input into the monitoring and inspection of the proposed pipeline, according to Messrs. Walker and Stein in cross-examination by Arctic Gas. Mr. Steigenberger said that the regulatory agency should be a multi-disciplinary authority that goes beyond any individual service. Mr. Millen said he could see the advantages of a single authority. Vol. 104
15970-15975
- The site specific assessment would be better than general rules and guidelines as the final design is reached, the panel agreed in cross-examination by Arctic Gas. Vol. 105
16016-16020
- The panel listed the things which should be monitored during construction and operation and maintenance, in cross-examination by Commission Counsel. Vol. 105
16020-16024
- A multi-disciplinary, single authority which would have within it people responsible for enforcing the Fisheries Act, would be desirable according to Mr. Millen. Vol. 103
15823-15824
Vol. 105
16058-16064
Vol. 105
16112-16120
- A multi-disciplinary, single authority which would have within it people responsible for enforcing the Fisheries Act, would be desirable according to Mr. Millen. Vol. 105
16120-16122

b-13 Miscellaneous

- The highway river crossing problems at the Wrangling River and Rock River were explained by Mr. Millen in cross-examination by ITC/COPE. Mr. Walker explained the monitoring on the Pointed Mountain Pipeline. Vol. 104
15925-15933

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 105, 106, 110 and 111)

IMPACT ON LIVING ENVIRONMENT
CARC - CARIBOUYELLOWKNIFE, N.W.T.
December 17 and 18, 1975
January 15 and 16, 1976

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TOPIC: Phase III: Impact of the Proposed Pipeline and Mackenzie Corridor Development on the Living Environment.

CARC - CARIBOU

DATE: December 17 and 18, 1975 and January 15 and 16, 1976 in Yellowknife.

WITNESSES: CARC's panel consisting of:

- Dr. P.C. Lent: Associate Professor of Wildlife Management, University of Alaska.
- Dr. G.W. Calef: Research Scientist, Fish and Wildlife Service, Government of the Northwest Territories.
- Dr. A.T. Bergerud: Honourary Associate Professor in Biology, University of Victoria.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

Nil.

B. Environmental

b-1 Routing

- The Arctic Gas route is environmentally unacceptable, according to Dr. Lent. The Fairbanks route is preferable since it is already "mucked up". The Arctic National Wildlife Range is unique and irreplaceable. It must be avoided. Vol. 106 16181-16183
- The interior route is preferable to the coastal route, according to Dr. Calef. The analysis by Arctic Gas's consultant that points to a preference for the coastal route is misleading. The data can also be interpreted to show that the interior route is better. The caribou related advantages and disadvantages of the two routes were listed by Dr. Calef to demonstrate the superiority of the interior route. The interior route avoids the calving grounds and the post calving aggregation. The caribou would be in proximity to a pipeline for only 2 weeks on the interior route. They would be in the area of the coastal route for 2 months. The coastal route also has the disadvantage of crossing the U.S. Arctic Wildlife Range and the proposed Canadian Arctic Wildlife Range. Vol. 106 16203-16233
- The coastal route has many disadvantages, according to Dr. Bergerud. The most vulnerable times in the caribou life cycle are during calving and during the summer insect harassment, which both occur along the coast. Developments along the coast might, therefore, seriously affect the Porcupine herd. Calving grounds are a key piece of habitat for caribou. At calving the caribou are more vulnerable to predators and disturbance than at any other time. Conflicts with the post calving aggregation, which recently has concentrated around Camden Bay, must be avoided. Vol. 110 16754-16758
- The six advantages of the interior route, with particular reference to the consequences of an elevated oil line following construction of a gas pipeline, were described by Dr. Bergerud. An Vol. 110 16758-16759

important factor is that the pipeline activities will alter the caribou-wolf interaction. This could limit populations and should be investigated. Renewable Resources (consultant to Arctic Gas) did little work on the demography and movement of wolves.

- The panel agreed that the coastal route is the worst one for caribou, according to Dr. Lent. Vol. 110
16772
- An interior route that goes south of the Porcupine River would have advantages over the interior route as proposed, according to Dr. Calef in cross-examination by the Council for Yukon Indians (CYI). The six advantages are: (1) it would not enter the Wildlife Range, (2) areas south of the river are used less by the Old Crow people, (3) it would go through the Eagle Plains and other areas that have already been disturbed, (4) it would use the same pass as the highway, (5) it would be in an area where caribou would be less reactive to aircraft flights and (6) there is more evidence of disturbed terrain in the area. The Fairbanks route is the overall preferred route. Vol. 110
16845-16852
- The analysis by Renewable Resources (consultant to Arctic Gas) was strained in its documentation of preference for the coastal route, according to Dr. Bergerud in cross-examination by the CYI. Overall, the Fairbanks route sounds best. Vol. 110
16862-16863
- The caribou would cross the interior route during the August dispersal, according to Arctic Gas. Dr. Calef agreed and acknowledged that this conflicted with his evidence-in-chief which hadn't taken the August dispersal into account. Three quarters of the herd would cross the route according to counsel for Arctic Gas. The major part of the herd would have to cross the interior route in the spring as well. Vol. 111
16916-16920
- Considering all mammals, the interior route is still preferable to the coastal route, according to Dr. Calef in cross-examination by Arctic Gas. Vol. 111
16922-16925
- The buried pipeline would be alright if it was built as described on the coastal or interior route, according to Dr. Bergerud in cross-examination by Commission Counsel. The ensuing developments would cause problems. The key overwintering areas for the caribou haven't been identified. The use of snow roads could change the wolf/caribou interaction. Dr. Lent said he preferred the interior route. Dr. Bergerud pointed out that the calving and post calving activities are the most critical. An important consideration is that construction schedule "slippage" would be less a factor on the interior than on the coastal route. Vol. 110
16903-16906
- The major considerations, according to Dr. Calef in cross-examination by Commission Counsel, are: (1) to avoid the coast, (2) to regulate the work and overflights as suggested by the EPB, (3) to instigate further population research and (4) to implement game management schemes before work begins. Dr. Lent said consideration must also be given to courses of action if the recommendations are impossible to meet. Dr. Bergerud said more sophisticated demographic work is needed including more work on wolves. Vol. 111
16931-16937
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16955-16958

b-2 Calving

- Evidence exists in Alaska to show that the same calving grounds have been used for over a century, according to Dr. Lent. As the caribou populations decrease these areas shrink inward to the 'optimum core' areas for each subpopulation. These are critical areas. The timing of the caribou's arrival to these areas coincides with the first new growth of cottongrass tussocks. Vol. 105
16133-16138

- Calving takes place on the coast on both sides of the proposed pipeline alignment, according to Dr. Lent in cross-examination by Arctic Gas. Vol. 110
16890-16892
- Caribou choose their calving grounds because of the freedom from wolves and insects and because of the nutritional advantages of the area, according to Dr. Bergerud and Dr. Lent in cross-examination by the ITC/COPE. If man's activities force them elsewhere, the second choice may not be good enough for survival. Dr. Calef stressed the importance of calving and post calving periods emphasizing that more information is required on caribou pregnancy rates, live births and calves-at-heel. Vol. 110
16830-16835
16788-16795
- The calving on the coastal plain and on the foothills was described for the Judge by Dr. Calef based on his 1972 work. Dr. Lent said that work by Skoog in the 1960's showed calving west of Camden Bay. Dr. Calef explained that post calving aggregations for western Arctic herds involve most of the animals. East of the Mackenzie, however, there is a tendency towards 10 to 20 groups of animals of several thousand each. Vol. 111
16910-16916
Vol. 111
16920-16921

b-3 Caribou Movements and Population Factors

- The use of the coastal area as a winter range must be emphasized, according to Dr. Lent. The likelihood of caribou on the coastal area during pipeline construction is great enough to require contingency plans - particularly when one considers the possibility of construction schedule "slippage". Also, caribou can enter the coastal calving areas as early as May which could overlap with the construction demobilization. This could lead to increased animal mortality. The calving locations vary slightly from year to year. An interference in the caribou's attempts to adapt to natural variation will be reflected undesirably on the population productivity. Man-caused mortality is supplementary to natural mortality and the effects are density dependent. Vol. 105
16139-16145
- The effects of a pipeline on caribou can't be predicted with certainty and therefore, it is important to err on the side of caution, according to Dr. Calef. More information is needed on: Vol. 106
16188-16194
Vol. 110
16781-16784
 - (1) accurate population estimates, (2) movements and distribution of animals throughout the year, and
 - (3) demographic characteristics of the herd. Without this information impacts can't be assessed.
 Dr. Calef went on to describe the data available on caribou herds in northern Canada and Alaska pointing out that none of the information is sufficient to explain the population dynamics of the herds.
- The natural regulation of caribou populations occurs through a fine balance between birth rates and death rates, according to Dr. Bergerud. Predation and not range and food regulates the populations. The population of the Porcupine herd seems to be in balance now. This could be altered by changing the wolf/caribou interactions. Development could give the wolves the advantage. Vol. 110
16751-16754
- Human and natural impacts are cumulative and must be summed, according to Dr. Lent in cross-examination by ITC/COPE. Evidence of this has been seen in the western Arctic herd in Alaska. Dr. Calef said this emphasizes the need for continuity in population estimates. Population changes are often observed but there is no way to find out if the change was gradual or sudden. More needs to be known about the effect of wolves. When asked if there was a threshold population below which recovery was impossible, Dr. Bergerud said he Vol. 106
16264-16273
Vol. 110
16795-16796
Vol. 110
16835-16837

- There are insufficient data on which to base cause effect analysis on population changes, according to Dr. Lent in cross-examination by Foothills. Dr. Calef explained the history of the 40-mile herd and the effects of the Steese Highway to illustrate this point. Vol. 110
16871-16873
- There is evidence that caribou movements are timed to take advantage of nutrient availability at certain times and places, according to Dr. Lent in cross-examination by Arctic Gas. He said that the Nelchina herd's reduction may be due to emigration and wolf predation. Vol. 110
16881-16882
16882-16885
- Alaskan experience has shown that a disproportionate number of bulls appear along the corridor indicating that cows are more sensitive to disturbance, according to Dr. Lent. Vol. 105
16169-16170

- The elevated pipeline simulation experiments were done in Alaska were explained by Dr. Lent with the aid of a film. The conclusion was that where total pipe burial is not possible ramps are the preferred method to allow caribou to cross. Vol. 105
16145-16152
- Wherever caribou populations come into contact with settled areas they experience a decline, according to Dr. Lent. The Steese-Forty Mile and Nelchina herds were cited as examples. The causative factor in these cases can't be fully isolated but the circumstantial evidence is not encouraging. The Alaska Peninsula and Porcupine herds are the only two major populations left west of the Mackenzie. Both, until recently, were wilderness populations. Vol. 106
16177-16181
Vol. 110
16779-16780
- The wisdom of rapid exploitation of the North should be questioned, according to Dr. Bergerud. Caribou are a vital part of the ecosystem. Investigation of relic caribou herds indicates that major changes to the ecosystem cause declines in herds. Vol. 110
16744-16747
- The history of caribou/human interaction in the Forty-mile, Kaminuriak and Churchill Fall herds was described by Dr. Calef. In every case there is insufficient information to make cause/effect evaluation of the population changes. The general conclusions that can be made are: (1) calf survival rates decline when the herd is driven from its traditional calving grounds, (2) disturbance influences are felt over a long period of time, (3) the effect of the disturbance depends on its intensity, (4) disturbance effects are additive and (5) populations may be cyclical over 20 to 50 year periods. The significance of the field experiments is not as great as the applicant leads one to believe. For example, the compressor station noise simulation reproduced only one aspect of compressor station disturbance. Such experiments don't give the hard data needed. Vol. 106
16233-16238
- Human activities, such as road use, that affect caribou range abandonment should be examined so effective regulations can be developed, according to Dr. Lent. In cross-examination by Foothills, Dr. Lent said the behavioural changes caused by man made changes are not known. Vol. 110
16780-16781
- One of the main problems associated with caribou harassment is calf-cow separation, according to Dr. Calef. Dr. Bergerud explained the calf-cow relationship and Dr. Lent emphasized the need for more knowledge in this area. Vol. 110
16816-16821

- If there is no regulation of public access during construction, there will be serious implications, according to Dr. Lent in cross-examination by the CYI. In cross-examination by ITC/COPE, Drs. Calef and Bergerud explained that caribou hesitate at roads in proportion to the volume of traffic on the road. The clearings, packed snow and salt attract ungulates. Traffic should be restricted or stopped during certain periods. Vol. 110
16865-16867
- A 1,000 foot minimum for flights over caribou is adequate except during calving periods, according to Dr. Calef in cross-examination by the CYI. The 2,000 foot minimum recommended by the EPB is even better. Renewable Resources recommended that there be no overflights during calving and post calving periods, according to Arctic Gas. Vol. 110
16860-16861
- Caribou can adapt to man if the right environmental mix exists, according to Dr. Bergerud in cross-examination by ITC/COPE. Dr. Bergerud, in cross-examination by Arctic Gas, said he disagreed. Man's effect could shift the delicate balance existing in the caribou herd in the wrong direction. Vol. 110
16837-16838
- The Prudhoe Bay caribou herd hasn't declined yet despite the developments there, according to Dr. Lent in cross-examination by Arctic Gas. Calving occurs east of the oil field and migration is parallel to the corridor. The disturbance caused by an elevated pipeline wouldn't necessarily be similar to that caused by surcharge berms or roads associated with the chilled, buried gas pipeline. Vol. 110
16892-16893
- The human activity associated with the noise aspects of compressor station operation would compound the impact for caribou, according to Dr. Calef in cross-examination by Arctic Gas. The disadvantages of a pipeline through the Canning River Valley (interior route) are over-emphasized by Arctic Gas. Vol. 110
16885-16890
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16928-16931

b-5 Caribou Herds and Reindeer Herds

- The differences between caribou and reindeer are not very significant for the present considerations, according to Dr. Lent. Information on reindeer is applicable to assessment of impacts on caribou. Vol. 110
16776-16779
- The possible effects of development on the reindeer herd, according to Dr. Lent in cross-examination by Commission Counsel, are: (1) fragmentation of range, (2) pressure causing contact with the Bluenose caribou herd and (3) the herders leaving to work at higher paying jobs. Vol. 111
16945-16946
- The Bluenose herd is expanding west and currently numbers about 100,000 according to Dr. Calef in cross-examination by Foothills and Commission Counsel. The pipeline and Producers facilities will conflict with the Bluenose and reindeer herds. Reindeer forced into contact with caribou herds often get absorbed. Also caribou attract wolves which can cause problems to the reindeer. Diseases are also transferred from caribou to reindeer. The development of roads, above ground feeder lines and the effects of sulphur dioxide on vegetation will all cause some harm to the herds. Vol. 110
16869
Vol. 111
16937-16943
- The differentiation between woodland, barren land and mountain caribou have no operational meaning, according to Dr. Bergerud in-chief and in cross-examination by Foothills. The environment alters behaviour. For example, woodland caribou are probably more wary of man and less gregarious. These sorts of characteristics will govern the reaction of the animals to a pipeline. Vol. 110
16750-16751
16874-16880

b-6 Monitoring and Surveillance

- Alyeska openly admits that winter construction has been far less successful than anticipated, according to Dr. Lent. The resulting slippage in construction schedule has major environmental ramifications. Dr. Lent quoted from reports to illustrate this point. The major problems in Alaska have been the enforcement of environmental standards and stipulations and in the accountability for actions. Environmental people in the field need to have the authority to stop environmental degradation on the spot. The Alaskan environmental briefings and education programs have been a travesty. Vol. 106
16159-16169
- The regulation of the gas processing plants, the gathering lines and the pipeline should be under one organization, according to Dr. Lent in cross-examination by ITC/COPE. The lack of control of the gathering areas in Alaska has resulted in terrain damage. The State is feeling the financial impact as it tries to cope with staffing to monitor, enforce and deal with violations in the courts. The situation with respect to JFWAT (Joint State/Federal Fish and Wildlife Advisory Team) is different because it is financed by industry. There is an ongoing though limited effort to monitor wildlife on Alyeska - particularly caribou and moose. People from Alaska should appear at the Inquiry to describe problems such as: (1) employees being fired and court cases resulting from environmental insults, (2) falsification of welding x-rays making it necessary to dig up the line and re-x-raying it, (3) numerous oil and fuel spills and (4) lack of effective recourse when employees feed wild animals. This should be a criminal offense. Vol. 106
16251-16259
- Monitoring and surveillance of the caribou herd would take 4 to 6 full time people with a budget of \$100,000 to \$200,000 per year, according to Dr. Calef in cross-examination by the CYI. The problems of detecting and assessing population changes were described by the panel. Vol. 110
16852-16860
- In Alaska, the pipeline monitoring does not include the oil field activities, according to Dr. Lent in cross-examination by Commission Counsel. Vol. 111
16943-16954

b-7 Wilderness and Wildlife Range

- Caribou are wilderness animals in two respects, according to Dr. Bergerud: (1) they need large areas in which to roam and (2) they are unwary of man. The problem to be addressed is not if the caribou can live with man but rather, can people live with caribou. It is man that causes the problems, not the caribou. Dr. Lent agreed that caribou are an integral part of wilderness. A definition of wilderness (as contained in the U.S. Wilderness Act) was read by Dr. Lent. It was pointed out by Dr. Lent that: (1) the large migrations can't be sustained in a highly altered environment and (2) calving grounds are all in "wilderness" areas. Vol. 110
16749-16750
- The statements by Arctic Gas' Mr. Hemstock about the availability of other areas similar to the Arctic National Wildlife Range is erroneous and misleading, according to Dr. Lent in cross-examination by ITC/COPE. There are no alternative areas because of the present legal status of areas to the west. A study of the Wildlife Range as a wilderness area was conducted in the early 1970's. Dr. Lent urged the Inquiry to obtain a copy. Vol. 110
16865
Vol. 110
16772-16776
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16246-16255
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16183-16187

b-8 Game Management

- The Porcupine herd could decrease by 90% in 5 to 10 years because of development in the same way that the Forty-mile and Nelchina herds declined, according to Dr. Calef. The true environmental impact resulting from the pipeline project will be negligible simply because the cause of the impact could not be attributed directly to the pipeline. Knowledge is required on: (1) winter ranges and their changes year to year, (2) migration - how it is learned and the migration route advantages, (3) calving grounds and their advantages, (4) the reason for summer movements and (5) the birth/death balance factors. Vol. 106
16238-16240
- The Federal Government should be responsible for the Porcupine herd and should set aside an area for its preservation, according to Dr. Bergerud. Statistics that need to be gathered for herd management include: (1) status of the herd, (2) birthrates, (3) age structures, (4) the percentage of calves in October and March and (5) the status of wolf populations. Vol. 110
16769-16771
- The Arctic Gas work was mostly single species studies with little attempt at integration, according to Dr. Bergerud. The data isn't susceptible to ecosystem analysis. Also, it is directed only at the short-term impact of a buried gas pipeline, but such a pipeline will be followed by other developments. The Porcupine herd can withstand the short-term effects of a buried pipeline. It can't withstand the long-term effects. Vol. 110
16745-16748
- The future research as outlined by Dr. Bergerud should be pursued according to Drs. Lent and Calef in cross-examination by ITC/COPE. Dr. Bergerud said that one way to get all the required information quickly would be take a large sample of animals - up to 1,000 - and, using a team of specialists, take all the necessary data. A similar approach was used by the CWS in their study on the Kaminuriak Herd. This would be a start at effective management. The quantification of animal response to roads, etc., should also be pursued so that the additive effects of development can be assessed. Vol. 110
16796-16816
- More coordination, with an international agreement on the caribou herd, is necessary for effective management, according to the panel in cross-examination by ITC/COPE. The present situation is chaotic. Vol. 110
16827-16830
- The present management of the Porcupine herd would be better termed non-management, according to Dr. Calef in cross-examination by the CYI. It is amusing and hopeless. Dr. Bergerud said that the Federal Government should be responsible for the herd because it has better expertise, a better caliber of science and is less prone to backyard politics. Vol. 110
16863
- There should be a no hunting zone along the pipeline corridor and highways, according to Dr. Calef in cross-examination by Foothills. The monitoring during construction would continue as part of the herd management scheme after construction. Vol. 110
16867-16869
16873-16874
- The increased load on game management agencies in Alaska because of the Alyeska project was described by Dr. Lent in cross-examination by Commission Counsel. About 30 biologists and technicians are employed in direct monitoring. Most of the cost of this work is reimbursed by Alyeska. No significant staff expansion has occurred to deal with indirect effects of the pipeline like oil field developments. The State can't address these issues because of budget restraints. Before construction, the statutes should have been Vol. 111
16946-16955

reviewed to ascertain their adequacy to deal with development-related problems like harassment and feeding of wildlife. Enforcement depends on ability to handle cases. Judges and magistrates are overworked. Dr. Lent said he hoped Canada would "beef-up" its game management before developments. Dr. Calef agreed, saying that a formal monitoring plan developed by the Inquiry could be followed up after construction. The strain caused by increased access and population should be assessed.

b-9 Musk Oxen

- The transplant of musk oxen on the north slope in 1969 to 1970 was described by Dr. Lent in cross-examination by ITC/COPE. The animals were in the area in the 19th century but were hunted to extinction. Musk oxen are sensitive to disturbance particularly during and after calving (mid April to May). Calves and cows that are separated are less likely to be re-united than are caribou calves and cows. Vol. 106
16241-16246

b-10 Buffalo

- The current work on buffalo in Wood Buffalo National Park and the Buffalo Sanctuary near Fort Providence was described by Dr. Calef in cross-examination by ITC/COPE. The large growth rate of the Providence Wood Bison herd indicates the capability of that habitat. The herd in the Park are hybrids of wood and plains buffalo. That herd is 30 - 40% infected with TB and brucellosis. The herd is in a period of decline and current work is aimed at finding out why. Vol. 110
16838-16845
Vol. 110
16784

b-11 Alaska Conservation Society

- Dr. Lent addressed the Inquiry as a representative of the Alaskan Conservation Society saying that the Society may present a formal brief to the Inquiry. They feel the Inquiry is very worthwhile and would like to see more like it in the U.S. Dr. Lent filed as an exhibit the Society's periodical dealing with oil and gas development.

b-12 Miscellaneous

- Government environmental reports on the Beaufort Sea were filed as exhibits by Commission Counsel. Vol. 110
16737-16738
- LGL's report for Arctic Gas on the birds on the cross-Delta route was filed. Vol. 106
16277-16278
- Fisheries studies on the cross-Delta route were filed by Arctic Gas. Vol. 110
16822
- The Wilderness Study Report on the Alaska National Wildlife Range was filed by CARC. Vol. 110
16822
- A preliminary logic diagram illustrating the repair of a line break was filed by Arctic Gas. Vol. 105
16128

C. Socio-Economic

c-1 Alaska Pipeline Impact

- The impact of the Alyeska pipeline on life in Fairbanks was described by Dr. Lent in cross-examination by ITC/COPE. Air pollution, ice fog, schooling in shifts increases in crime rates, housing problems, overloaded communications facilities and rapid turnover of personnel were all cited as impact examples. Fairbanks was about twice as big as Yellowknife before the pipeline and now it has a population of about 50,000. Vol. 106
16273-16277

c-2 Native History

- Father Fumaleau presented a copy of his new book to the Judge. It is entitled "As Long as This Land Shall Last".

Vol. 106
16154-16155

D. Miscellaneous

nil

E. Inquiry ScheduleMarch

1 - 12 Community hearings in Tuktoyaktuk, Sachs, Holman and Paulatuk.

15 - 26 Formal hearings in Yellowknife.

April

5 - 15 Formal hearings in Yellowknife.

26 - 30 Formal hearings in Yellowknife.

May

3 - 12 Formal hearings in Yellowknife.

12 - 31 Community hearings in southern Canada: Vancouver, Edmonton, Calgary, Regina, Winnipeg, Toronto, Ottawa and Montreal.

June

1 - 5 Community hearings in southern Canada: Vancouver, Edmonton, Calgary, Regina, Winnipeg, Toronto, Ottawa and Montreal.

14 - 18 Formal hearings in Yellowknife.

18 - not yet determined.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 135 and 136)

WATER QUALITY CRITERIA

YELLOWKNIFE, N.W.T.
MARCH 25 and 26, 1976

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b-2 Implementation and Inspection Cont'd.TRANSCRIPT
REFERENCE

- The biological standards are most useful for summer activity and monitoring should continue for at least one summer following construction, according to Dr. Sprague in cross-examination by Foothills.
- A special code of regulations is required to supplement existing laws, according to Dr. Sprague in cross-examination by ITC/COPE. Generally, one water quality inspector per spread would be sufficient but training might be needed if additional skills and expertise were required.

Vol. 136
20659-20664
Vol. 136
20669-20670

b-3 Insecticides

- No insecticides should be used north of 60° except on a small scale and then only non-persistent ones should be used, according to Dr. Sprague in chief.

Vol. 135
20587-20590

b-4 Siltation

- The regulations should specify, according to Dr. Sprague in chief, (1) detailed practices for construction, land use and revegetation, (2) allowable turbidity levels and perhaps settleable solids, and (3) maximum allowable downstream disturbance.
- The benthic macro-organisms should not change more than 25% one quarter mile up or downstream of construction activity, according to Dr. Sprague in cross-examination by Arctic Gas and ITC/COPE. Benthic monitoring in winter is not very practical.
- The 1800 river and water crossings should be grouped with applicable standards for each, according to Dr. Sprague in re-examination. Two tests should be applied: (1) biological and (2) turbidity.

Vol. 135
20590-20595
Vol. 136
20646-20648
20651-20653
20670-20671

b-5 Petroleum

- Regulations should specify: (1) precise spill safeguards, (2) that no visible oil sheen be detectable on water and (3) that oil concentrations be less than 0.05 of the lethal concentrations for sensitive aquatic organisms, according to Dr. Sprague in chief.
- The oil sheen requirement would have to be related to background natural conditions, according to Dr. Sprague in cross-examination by Arctic Gas.
- The 0.05 figure should be a maximum, according to Dr. Sprague in cross-examination by ITC/COPE.

Vol. 135
20595-20597
Vol. 136
20648
Vol. 136
20671-20672

b-6 Sewage

- The regulations should specify: (1) that dissolved oxygen should not be less than that specified by the "Blue Book" for a high level of protection and (2) that effluent be lagooned for a year prior to disposal on land, according to Dr. Sprague in-chief and in cross-examination by Foothills.

Vol. 135
20597-20598
Vol. 136
20657-20659

b-7 Methanol

- The regulations should specify that methanol solutions: (1) be reduced to a 1% concentration prior to disposal and (2) if disposed of in water, be metered out so that the toxic effect is less than lethal level for fish or fish eggs, according to Dr. Sprague in chief and in cross-examination by Arctic Gas.

Vol. 135
20599-20600
Vol. 136
20648

b-8 TemperatureTRANSCRIPT
REFERENCE

- The regulations should specify the temperature discharge guidelines in accordance with the "Blue Book", 20598-20599 according to Dr. Sprague in chief. Vol. 135

b-9 Other Toxicants

- The regulations should specify that other toxicants (those not mentioned above) not be greater than the guidelines of the "Blue Book, according to Dr. Sprague in chief. Vol. 135
20601
- Fertilizers don't pose a long-term problem nor do sump fluids unless they are discharged into a stream causing sedimentation problems, according to Dr. Sprague, in cross-examination by ITC/COPE. Vol. 136
20675-20677

Policy and Planning
(ACND) Division,
April 10, 1976.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUME NO. 136)

FISHERIES

YELLOWKNIFE, N.W.T.
MARCH 26, 1976

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TOPIC: Phase III: Impact of the Proposed Pipeline and Mackenzie Corridor Development on the Living Environment.

Probable Effects of Pipeline Construction on the Domestic Fishery in the Mackenzie Valley.

DATE: March 26, 1976 in Yellowknife.

WITNESSES: Commission Counsel witnesses:

- R.F. Peet: Head, Fishery Management Division, Fish Resources Section, Fisheries and Marine Service, Department of the Environment, Winnipeg.
- W.J. Hunt: Fisheries Officer, Western Sub District, Fisheries and Marine Service, Department of the Environment, Inuvik.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

- nil

B. Environmental

b-1 Fisheries Service - General

- The task of the Fisheries Management Division is to develop, operate and maintain a management program for the fish resources of the N.W.T. in accordance with the provisions of Section 34 of the Federal Fisheries Act, according to Mr. Peet in chief. Management controls the sports and commercial exploitation but not domestic exploitation which is a right of Native peoples. The object is to regulate other activities so that domestic fisheries are protected.

Vol. 136
20691-20699
20745-20751

b-2 Domestic Fisheries

- The domestic fishery is important to Native peoples for social and economic reasons, according to Mr. Peet in chief. Fishing is usually done at the mouths of rivers along the Mackenzie and on some lakes. Figures on domestic utilization of the fish resource were given by Mr. Peet. In cross-examination by ITC/COPE he discussed the problem of defining a domestic and a commercial fishery.
- Since control over the domestic fishery is outside the Service's jurisdiction, control must come from the Native users themselves, according to Mr. Peet in cross-examination by ITC/COPE. The domestic fishery, by policy, is ranked as more important than commercial or sport fishery.
- A problem often arises where man's activities not directly related to fishing may hurt the fish resource, such as the proposed dredging of the Tuktoyaktuk harbour, according to Mr. Peet. There is a deficiency in legislation and enforcement powers.

Vol. 136
20699-20705

Vol. 136
20751-20753

Vol. 136
20730-20732

Vol. 136
20732-20734

b-3 Sports and Commercial FisheriesTRANSCRIPT
REFERENCE

- The Mackenzie Delta area has the greatest potential for sports and commercial fisheries exploitation, according to Mr. Peet in chief and in cross-examination by Arctic Gas. Generally, these fisheries are not highly developed in the Mackenzie Valley. Vol. 136
20705-20709
20718-20721
- The Holmes Creek fishery is the largest commercial activity in the area but its future is entirely up to the people in the region, according to Mr. Peet in cross-examination by Foothills. Vol. 136
20721-20725
- Certain areas could be used by pipeline workers for sport fishing but these haven't been identified, according to Mr. Peet in cross-examination by Foothills and ITC/COPE. Local people may have to be consulted. Enforcement of any prohibition of workers' fishing will have to rest with the pipeline companies. Areas such as the Husky Lakes could, at the Minister's discretion, be closed to outside fishing exploitation. Vol. 136
20725-20730
20757-20560
- Supply of construction camps from local commercial fisheries could probably be accommodated, according to Mr. Peet in cross-examination by ITC/COPE. He went on to outline some of the problems with transportation, weather, etc., that have plagued commercial fisheries in the past. Vol. 136
20760-20766
- The Great Slave Lake commercial fishing operation involves about 200 fishermen for a 2½ to 3 month season, according to Mr. Peet in response to the Judge's questions. It would probably not be affected by a pipeline. Vol. 136
20766-20768

b-4 Effects of Pipeline Construction

- The possible adverse affects of the pipeline construction, according to Mr. Peet in chief, are: 1) siltation, 2) removal of spawning bed gravel, 3) blockage of migration routes, 4) destruction of rearing areas and 5) chemical contamination. Details of fish habits and sensitivities were listed by Mr. Peet. No pipeline facility should be located near a domestic fishing site. The influx of a large number of people will also cause problems. Since the Fisheries Service can't deny citizens a fishing licence, it will be up to the pipeline companies to enforce a 'no fishing' regulation. In conclusion, Mr. Peet said: 1) the domestic fishery is of prime importance to Native people and should be protected, 2) with safeguards, and if the pipeline avoids domestic fishing sites, there should be no detrimental effects 3) there is no reason to completely ban sports fishing by pipeline workers and 4) more commercial fisheries should be encouraged. Vol. 136
20709-20717
- The Service has not been told to get involved in devising a system to interact with the proposed pipeline activity although gaps in knowledge are known to exist, according to Mr. Peet in cross-examination by ITC/COPE. The catch per unit effort may be a useful means of assessing impact but those statistics are very difficult to get. Vol. 136
20734-20745

b-4 Effects of Pipeline Construction (Cont'd)TRANSCRIPT
REFERENCE

- The local people should have a voice in determining pipeline facilities locations near domestic fishing sites, according to Mr. Peet in cross-examination by ITC/COPE.

Vol. 136
20753

Policy and Planning
ACND Division
April 11, 1976.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES NOS. 111 AND 137)

ENVIRONMENTAL IMPACT STATEMENTS
AND ROUTE SELECTION METHODOLOGYYELLOWKNIFE, N.W.T.
JANUARY 16 AND APRIL 5, 1976

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TOPIC: Phase II, III: Impact of the Proposed Pipeline and Mackenzie Corridor Development on the Physical and Living Environments.

Environmental Impact Statements and Route Selection Methodology.

DATE: January 16 and April 5, 1976 in Yellowknife.

WITNESS: Commission Counsel witness:

Dr. G.S. Davies: Manager, Ecological Studies Division,
James F. MacLaren Ltd.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

- nil

B. Environmental

b-1 Impact Statements - General

- The state-of-the-art of environmental impact statements (EIS) in Canada was described by Dr. Davies, in chief, making specific reference to the Federal and Ontario Government processes. The five major problems are: (1) the EIS is only as good as the guidelines upon which it is based and the guidelines themselves are still in an embryonic state, (2) the EIS often contains irrelevant information, (3) the EIS is often incomplete, particularly with respect to indirect impacts, (4) quantitative evaluations are often lacking, and (5) the EIS often only pays lip service to alternatives and the 'no project' alternative. The methods which can be used to select and evaluate corridors and routes within corridors were illustrated with examples by Dr. Davies in chief. A synthesis of the various methodologies results in the following steps: (1) setting of objectives by a multidisciplinary team, (2) selecting the alternative corridors possible, (3) defining the data required for an environmental inventory, (4) eliminating the obviously unviable corridors, (5) making field visits, and (6) selecting the route. Three route selection methods which could then be applied were described by Dr. Davies. The mechanism for choosing should employ a numerical rating based on subjective comparative values. A technique of using "trade-off curves" and "preference curves" to arrive at a "choice" was described by Dr. Davies. The object is to use a systematic approach so others can see how decisions were arrived at. In reexamination by Commission Counsel Dr. Davies said that the process of arriving at an environmentally acceptable route is very important since it must be amenable to public scrutiny.

Vol. 111
16968-16978

Vol. 111
16981-17000
Vol. 137
20800-20814

Vol. 137
20871-20872

b-2 Applicants' ProcessTRANSCRIPT
REFERENCE

- The applicants have not given adequate treatment to alternative routes and corridors, according to Dr. Davies in chief. Specific examples of where this is apparent were listed. Generally, the three areas where environmental damage can be minimized are: (1) location, (2) engineering design and, (3) monitoring and surveillance. Vol. 111
16978-16981
- The example approach described utilizes established decision science and operations research techniques that the applicant has probably used in making technical evaluations, for example, pipe sizes, throughput, compressor station spacing, etc., according to Dr. Davies in cross-examination by ITC/COPE. A similar methodology should have been used for the routing and environmental work so it would be clear what the objectives were. The public should have access to the assessment work in order to be able to affect the design in its early stages. In many cases the initial guidelines presuppose the project itself. The multiple choices are narrowed down to a few viable alternatives for biological assessment work. It is not apparent that the applicants did this. "As an environmentalist, I'm not convinced this is the right corridor." It isn't apparent what Arctic Gas' objectives were in gathering their information. There is a lot of baseline data without much attention being paid to the process. Ultimately the "costs" must be based on the judgement of specialists. Tangible quantifiable costs form the basis for this judgement. Arctic Gas' work leaves unclear what evaluations were made which, in turn, makes public evaluation difficult. Vol. 137
20833-20837

Vol. 137
20815-20821

Vol. 137
20821-20826

Vol. 137
20826-20833
- The techniques outlined have never been applied to a project of the scale proposed here, Dr. Davies agreed in cross-examination by Foothills. Vol. 137
20841-20844
20855-20861
- The factors which must be considered in alternative route/corridor selections, according to Arctic Gas in cross-examination of Dr. Davies, are: (1) engineering feasibility, (2) scheduling, (3) cost, (4) resource requirements, (5) environmental factors, (6) social considerations, and (7) micro and macro economic considerations. In the final analysis the trade-offs are based on subjective evaluations by experts. The problem with the Arctic Gas work is that it is unclear what their objectives were and what judgements were made. Vol. 137
20862-20870

b-3 Establishing Background Data

- The onus for generating data should be divided between the industry and government for projects in a frontier area like the North, according to Dr. Davies in cross-examination by Foothills. The applicability of laboratory information to a field situation was questioned by Foothills. Vol. 137
20844-20852

C. Socio-Economic

- nil

D. Miscellaneous

- The admissibility of COPE's evidence on a Japanese oil spill was disputed by Arctic Gas and Foothills. The Judge ruled that it should be heard.

TRANSCRIPT
REFERENCE

Vol. 137
20770-20791
20837-20840

Policy and Planning
ACND Division
April 11, 1976.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUMES 137, 138, 139)

Commission Counsel Witnesses on
Fish, Wildlife and Birds

Yellowknife, N.W.T.

April 5, 6, and 7, 1976

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TOPIC: Phase III: Impact of the Proposed Pipeline and Mackenzie Corridor Development on the Living Environment.

1. Effect of Northern Pipeline Construction on Wildlife Management in the Yukon (Mossop)
2. Response of the N.W.T. Fish & Wildlife Service to Population Growth, Exploration and Industrial Development (Simmons)
3. Canadian Wildlife Service: Migratory Bird Management Responsibilities and Activities in Northern Canada (Stephen)
4. Effects of the Trans-Alaska Oil Pipeline Construction Phase on Fish and Wildlife Management (Norton)

DATE: April 5, 6, & 7, 1976 in Yellowknife.

WITNESSES: Commission Counsel witnesses:

D.H. Mossop:	Biologist, Yukon Territorial Game Branch
Dr. N.M. Simmons:	Superintendent, Fish & Wildlife Service, Government of the N.W.T.
Dr. W.J.D. Stephen:	Regional Director, Western Region, Canadian Wildlife Service.
Dr. D.W. Norton:	Affiliate Assistant Professor of Ecology, Institute of Arctic Biology, University of Alaska.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

a-1 Schedule

- | | |
|---|--|
| - A winter shutdown of two months was necessary on the Alyeska pipeline construction because of the inability of men and equipment to work in the extreme cold and darkness, according to the text of a speech by the Alyeska Senior Project Manager which was filed as an exhibit. The Judge asked Commission Counsel to pursue this matter and have evidence called from Alaska since this indicates that the Arctic Gas schedule as proposed isn't viable. | Vol. 139
21134-21135
21162-21166 |
|---|--|

B. Environmental

b-1 Game Management - General

- | | |
|---|--|
| - The game management programs are designed primarily to satisfy the food and psychological requirements of indigenous people, according to Dr. Simmons in-chief. The organization of the N.W.T. Fish and Wildlife Service was outlined. The present work is an overload so the service must grow. The Service can't cede any wildlife management responsibilities to other agencies. | Vol. 137
20898-20914 |
| - The three general game management priorities in order, are: (1) to maintain a sufficient population to permit subsistence harvest by native peoples, (2) to maintain a population sufficient for | Vol. 138
21074-21077
Vol. 139
21143-21146 |

resident hunters and (3) to maintain a population sufficient for non-resident hunters, the panel agreed in cross-examination by ITC/COPE. The CWS also has international and interprovincial obligations Dr. Stephen noted.

- The jurisdiction of DIAND over wildlife habitat leads to jurisdictional problems that are often ineffectively resolved, according to Mr. Mossop in cross-examination by the Council for Yukon Indians (CYI). One year of studies before pipeline construction begins is a minimum requirement according to Dr. Simmons. Vol. 138
21024-21025
- A buffer zone along the right-of-way and wildlife rezoning are ways of imposing restrictions during construction, according to Dr. Simmons in cross-examination by Foothills. Employees (native) with General Hunting Licences would have to be prohibited from hunting by company regulations. In cross-examination by ITC/COPE the panel agreed that the industry's activities could affect the harvestable game and birds, and this would conflict with management objectives. Vol. 137
20990-20993
- The native land use records of the NWT Service are probably understated, according to Dr. Simmons in cross-examination by the NWT Indian Brotherhood/Métis Association. Vol. 138
21078-21079
21081-21084
- The native land use records of the NWT Service are probably understated, according to Dr. Simmons in cross-examination by the NWT Indian Brotherhood/Métis Association. Vol. 138
20985-20986

b-2 Canadian Wildlife Service (CWS) - General

- The Canadian Wildlife Service (CWS) is solely responsible for the administration of the Migratory Birds Convention Act and its related regulations, according to Dr. Stephen in-chief. The administrative structure of the CWS was described. Cumulative effects of developments are reductions in quality and quantity of migratory bird habitat. It is unlikely that the CWS will be in a position to gather or supply the data necessary to ensure adequate protection of migratory birds in the North. To meet the requirements imposed by development 21 man-years and \$590,000 are required. Also co-ordinated inspection and ongoing monitoring will be needed. Vol. 137
20920-20941
- Within bird sanctuaries the CWS can refuse an application for activity even if DIAND approves it, according to Dr. Stephen in cross-examination by ITC/COPE. A bond is not requested but it is DOE's policy that the polluter pays. Vol. 139
21151-21158
- The insistence of industrial activities to continue once they begin is a constant problem that regulatory agencies face, the panel agreed during cross-examination by ITC/COPE. As an example, ITC/COPE filed as an exhibit, the Imperial Oil violation at Garry Island. Four other examples of the failure of the agencies to keep activity within the bounds of permits were cited by ITC/COPE: activities of Imperial Oil, Shell, Sun Oil, and Chevron in the Kendall Island sanctuary. No prosecution resulted from any of these cases, according to Dr. Stephen. Political concerns are taken into account in such cases, but not when considering individual harassment violations. Vol. 139
21084-21097
21097-21112
- Aircraft overflight regulations are enforced in sanctuaries with the co-operation of MOT, according to Dr. Stephen in cross-examination by ITC/COPE. Vol. 139
21158-21161

b-3 Northern Yukon Concerns

- The almost total lack of work by the Yukon Game Branch in the Arctic Yukon makes it completely impossible to make meaningful management decisions, according to Mr. Mossop in-chief. The work and staff of the Game Branch were described. Very little is known about the animals in the northern Yukon but experience elsewhere has shown that the animals experience a sharp decline with development activities. There isn't sufficient time to satisfy the research requirements if the pipeline schedule is followed. Three new Game Branch detachments would be required in the area at a cost of about \$700,000. Vol. 137
20878-20894
- The effect on game of opening the area through increased use of the Dempster and construction of three new access roads (if the Interior route were used) is unknown, according to Mr. Mossop in cross-examination by the CYI. The wildlife populations of the northern Yukon are the envy of biologists throughout North America but its management ranks are as low as anywhere. The people who did the wildlife research for Arctic Gas are the experts and they should provide help in developing a management program. The past management and research efforts relating to the Dempster highway and the Porcupine Caribou herd have been inadequate. They were desperate. The Game Branch has no authority over highway construction activities; they simply observe the effects. A moratorium on caribou hunting in the area would be advisable. Vol. 138
21012-21014
21021-21024
- There shouldn't be any pipeline in the northern Yukon at all if one has to assume (as per the pipeline guidelines) that it will become the route of an energy corridor, according to Mr. Mossop in cross-examination by the CYI. In cross-examination by the CYI, ITC/COPE and Foothills, Mr. Mossop said that many of the concerns would be alleviated by using a route along the Alaska highway (Fairbanks Corridor). Vol. 138
21014-21016
Vol. 138
20993-20995
21016-21018
21072-21074
- There is a four-or five-fold discrepancy between the applicant's bird counts in the Old Crow Flats and those of the Game Branch, according to Mr. Mossop in cross-examination by the CYI. The work done on the flats was described. Vol. 138
21025-21029

b-4 Caribou

- A joint CWS-NWT Fish and Wildlife Service study of the Porcupine Caribou herd has been done, according to Drs. Simmons and Stephen in cross-examination by the CYI and ITC/COPE. It was part of a pipeline-related study done in 1974 but it has not yet been published. Dr. Stephen explained the levels of wildlife protection offered by sanctuaries, reserves, parks and wildlife ranges. Vol. 138
21029-21035
Vol. 138
21037-21043

b-5 Surveillance/Enforcement/Monitoring

- CWS liaison with industry should be at the field, management and executive levels, according to Dr. Stephen in cross-examination by Foothills. The main CWS concern will be during summer pipeline activities. Vol. 138
20997-21002

- The Yukon Game Branch can't react on the scale necessary in the northern Yukon according to Mr. Mossop in cross-examination by the CYI. Vol. 138
21020-21021
- The fourteen points on enforcement made by Mr. Hugh Trudeau (in Inuvik) were reviewed with the panel by ITC/COPE. The panel generally agreed. The points are: (1) where no research exists, regulations should be conservative and then modified as further experience dictates, (2) enforcement is an integral part of management, (3) enforcement officers must be able to take action quickly, (4) the decision to instigate a prosecution should rest with the investigating officer with advice as necessary, (5) decisions to prosecute shouldn't be taken lightly, (6) regulations should be enforced impartially and the decision to prosecute should be a question of law and not subject to administrative or executive influences, (7) the public has the right to know what is happening, (8) the present penalties in game management are not deterrents for individuals and particularly for large companies, (9) a further deterrent is public exposure resulting from prosecution, (10) rather than increase fines the courts should order a clean-up and/or direct that technology be improved, (11) the same standards should apply to every operator regardless of affiliation (ie crown corporations), (12) enforcement should strive for 100 per cent compliance, (13) the high cost of operating in the North plus the problems of weather may make industry cut back on environmental safeguards and (14) specific "black and white" regulations are the easiest to enforce but don't always deal with the necessary problems. Vol. 138
21043-21069
- The Game Branch would concentrate on the post construction era when they would need to be a competent management agency, according to Mr. Mossop in cross-examination by ITC/COPE. The pipeline company should supervise its own people, with overall construction regulation being done by a Federal agency. Vol. 138
21069-21072
- The cost of inspection should be kept "at arms length" from the operator, according to Dr. Stephen in cross-examination by ITC/COPE. Costs may be recovered indirectly. Vol. 139
21161-21162
21167-21169
- The operator should be committed to repairing whatever damage results from his operations, according to Mr. Mossop in cross-examination by the CYI. A tribunal could be set up to settle long-term, adverse effect claims. Vol. 138
21018-21020
- Native people will be used as resource managers this summer, according to Mr. Mossop in cross-examination by the CYI. Vol. 138
21029
- An increase in incidences of man/bear conflicts has raised the cost of surveillance, and in many cases the operators pay the cost of this, according to Dr. Simmons in cross-examination by ITC/COPE. Vol. 139
21146-21151

b-6 Surveillance Agency

- The operator and shortfalls of the Alaskan regulatory authority were described in some detail by Dr. Norton in-chief. The Joint State/Federal Fish and Wildlife Advisory Team (JFWAT) was a good idea but it had three general shortcomings: (1) its "Advisory" status was a mistake, (2) it was mobilized late and (3) it should have had a broader mandate covering air, water and quality surveillance. There Vol. 138
20941-20983

- The exercise of developing a monitoring agency is being worked out, according to Dr. Simmons and Dr. Stephen in cross-examination by Foothills and Arctic Gas. Vol. 138
20989-20990
Vol. 139
21169-21170
- The management responsibilities can't be delegated to the pipeline authority although policing within the corridor should be delegated, according to Mr. Mossop and Dr. Simmons in cross-examination by ITC/COPE. Working papers on these matters are being prepared. Dr. Norton said that checks and balances must exist within the central co-ordinating agency. Surveillance is absolutely necessary and monitoring should be undertaken concurrently, since long-range technical evaluation becomes increasingly important, especially if the route is to be used as a corridor. Biologists involved in the surveillance should be exposed to industries' processes. Dr. Simmons expressed the concern that there wasn't sufficient time to adequately train inspectors. Dr. Norton said that the DIAND paper commenting on the Alaska pipeline authority is remarkably accurate. Vol. 139
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- The report "Oil Exploration and the Bankslanders - a lesson in National Priorities" by Barry and Simmons was introduced as an exhibit by ITC/COPE. Dr. Simmons said he has no reason to alter any of the views expressed in that report. The report dealt with the interaction of industry, government and the society on Banks Island and pointed out that the government's work couldn't be taken at face value judging from the people's past experiences on Banks Island.

Nil

- Jack Marshall, lawyer for Arctic Gas, advised that he would be leaving the Inquiry to represent Arctic Gas at the NEB hearings in Ottawa. He will be replaced by Mr. John Steeves who will continue to be assisted by Mr. Daryll Carter.

MACKENZIE VALLEY PIPELINE INQUIRYSUMMARY OF PROCEEDINGS

(TRANSCRIPT VOLUME NO. 139)

AIRCRAFT OPERATIONS

YELLOWKNIFE, N.W.T.
APRIL 7, 1976

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b-3 Flight Frequency	139

TOPIC: Phase III: Impact of the proposed pipeline and Mackenzie Valley Corridor Development on the Living Environment.

A Summary of Transport Canada's Responsibilities and Activities Respecting Aircraft Operations in Northern Canada.

DATE: April, 7, 1976 in Yellowknife.

WITNESS: Commission Counsel witness:

M.A. Heacock: Inspector of Civil Aviation, Air Regulations Branch, Transport Canada.

HIGHLIGHTS

TRANSCRIPT
REFERENCE

A. Technical/Engineering

- nil

B. Environmental

b-1 Aeronautics Control Measures

- Aeronautics Control Measures are primarily designed to promote aviation and ensure that safety standards are maintained, according to Mr. Heacock in chief. Charts advise pilots of migratory bird areas, and pilots are requested to maintain an altitude of 2,000 feet over bird nesting areas and herds of wild animals. It would be difficult for MOT to guarantee full control but three measures can be taken: (1) private aerodromes should be used only with prior permission, (2) sensitive areas should be protected by Territorial Ordinances and (3) a publicity campaign should be undertaken to emphasize the need for wildlife protection. Vol. 139 21180-21186
- The control of airstrips after abandonment will have to be considered at the time of abandonment, according to Mr. Heacock in cross-examination by ITC/COPE. Vol. 139 21194-21195
- Pilots usually co-operate well in obeying the Notices to Airmen which is basically an education program, according to Mr. Heacock in cross-examination by ITC/COPE and Foothills. Vol. 139 21195-21197

b-2 Altitude Restrictions

- The 2,000 foot minimum altitude wouldn't be a problem for IFR flights but it would be a prohibitive restriction on VFR flights, according to Mr. Heacock in chief and in cross-examination by Arctic Gas, ITC/COPE Foothills and the Judge. IFR flights would need IFR ground facilities at both the origin and the destination. Only some of the larger helicopters are equipped for IFR. There would be problems if the 2,000 foot restrictions were placed on VFR flights. It would be better to use IFR. Vol. 139 21184-21185-21188-21193-21193-21194-21197-21199

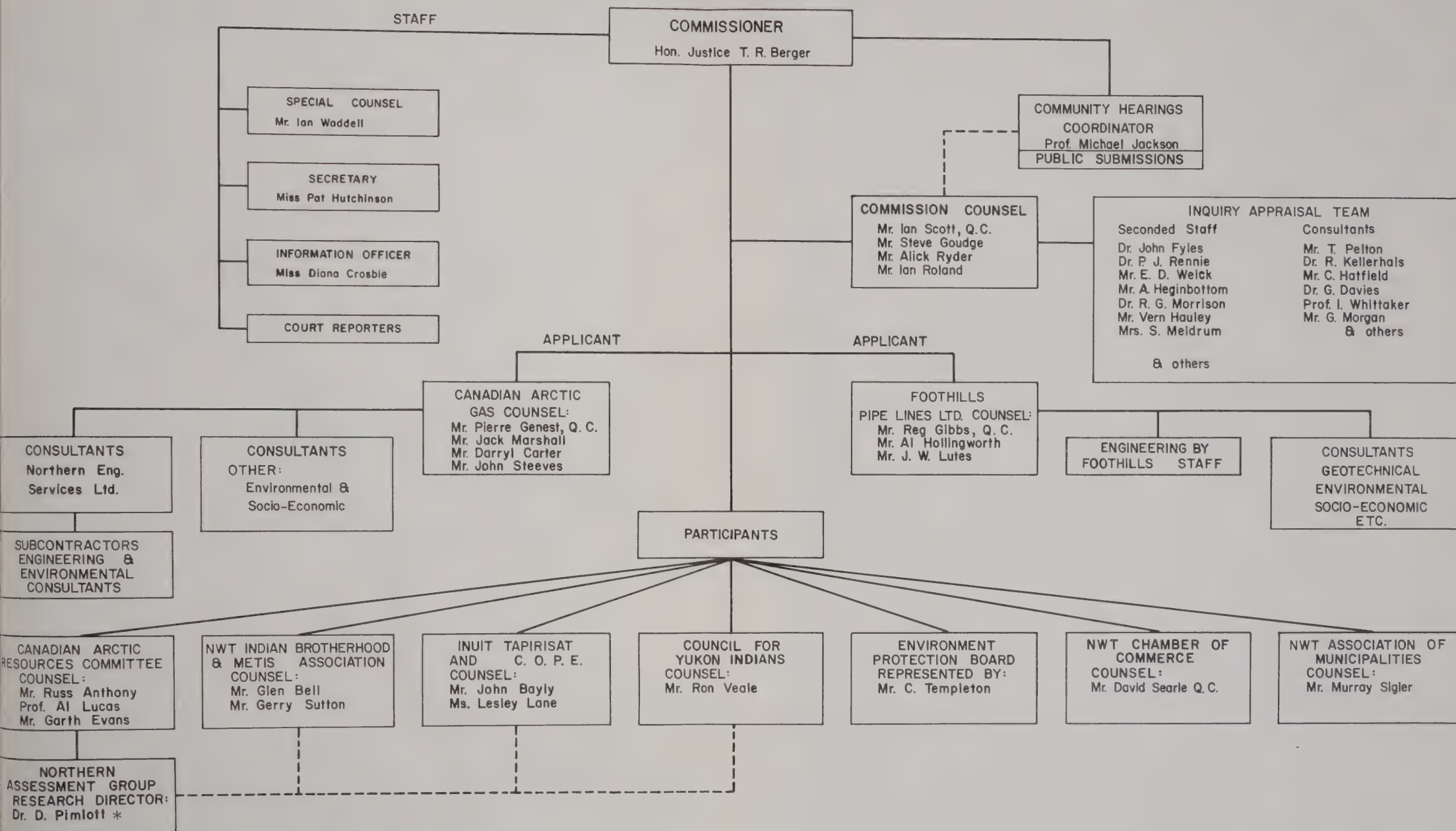
b-3 Flight FrequencyTRANSCRIPT
REFERENCE

- Flight frequency is difficult to forecast and control, according to Mr. Heacock in chief. Generally, there will be a 5 to 6 per cent annual increase in aircraft activity in the next 5 to 10 years. With a pipeline project, Inuvik, Norman Wells and Fort Simpson could expect a 30 per cent increase. A 100 per cent increase could be anticipated at Wrigley, Fort Norman and Norman Wells. An MOT aircraft activity report will be available in May.

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21185
21187-21188

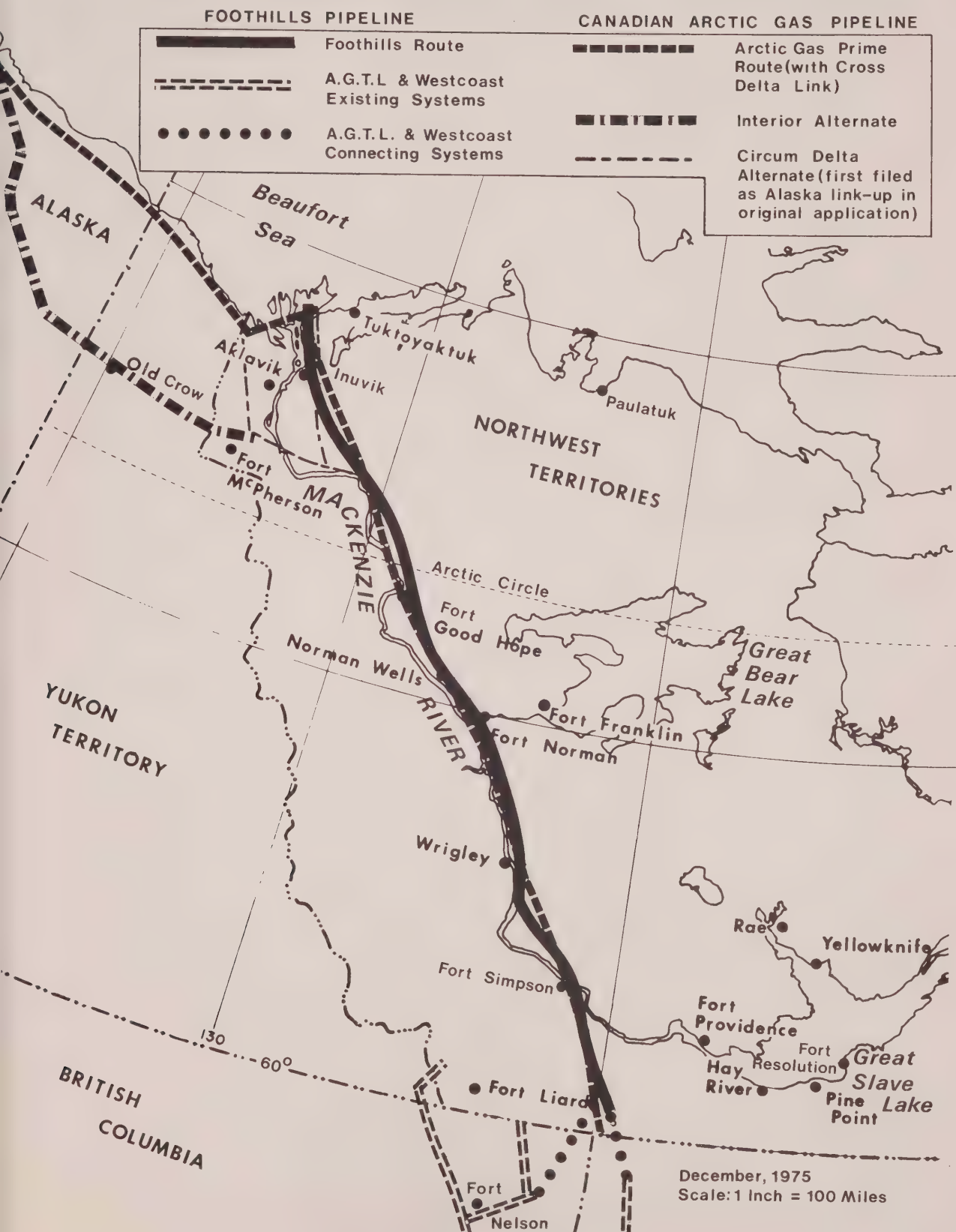
Policy and Planning
ACND Division
April 12, 1976.

MACKENZIE VALLEY PIPELINE INQUIRY



* Replaced Dr. J. Spence Jan. 1976

PROPOSED MACKENZIE VALLEY GAS PIPELINE ROUTES



MACKENZIE VALLEY PIPELINE INQUIRYINDEX TO SUMMARIES

<u>PLACE</u>	<u>SUBJECT</u>	<u>DATE</u>	<u>TRANS. NO.</u>	<u>SUMMARY* NO.</u>	<u>VOLUME** NO.</u>
Yellowknife	Overview Hearings	Mar 3-8	9-14	1	1
Yellowknife	Facilities Location and Connecting Pipeline Facilities (CAGPL)	Mar 11-14	15-18	2	1
Aklavik	Community hearing	Apr. 2-4	1-3	3	4
Aklavik	Community hearing	Feb. 23	40	3A	4
Yellowknife	Geotechnical Aspects of Engineering Design & Ancillary Facilities (CAGPL)	Mar 17-21 Apr. 7-14	19-29	4	1
Yellowknife	System Configuration & Design of Facilities (CAGPL)	Apr 14-18	29-33	5	1
Yellowknife	Construction Plan(CAGPL)	Apr 21-23 May 12-15	33-39	6	1
	Supplement	Sept 14	68	6A	1
Yellowknife	Operation & Maintenance (CAGPL)	May 16-21	40-42	7	1
Hay River	Community hearing	May 28-29	4-5	8A	4
Hay River Indian Village	Community hearing	May 30-31	6	8B	4
Yellowknife	Environment Protection Board	June 2-4	46-48	9	2
	Supplement	Sept 24-25	68-69	9A	2
	Supplement	Oct 15	72	9B	2
	Supplement	Jan 12-14	107-9	9C	2
Yellowknife	Policy (CAGPL)	May 21-24 June 5-6 Aug 18	42-45 49-50 56	10	1
Fort Franklin	Community hearing	June 24-26	7-9	11	4
Willow Lake & Fort Norman	Community hearings	June 26-27	10	12	4
Fort McPherson	Community hearing	July 8-10	11-13	13	4
Old Crow	Community hearing	July 11-13	14-16	14	4
Fort Liard	Community hearing	July 16-17	17	15	4
Fort Good Hope	Community hearing	Aug 5-7	18-20	16	4
Norman Wells	Community hearing	Aug 9	21	17	4

*Note: Individual Summaries available

**Note: Volumes 3, 4 and 5 not yet published.

PLACE	SUBJECT	DATE	TRANS. NO.	SUMMARY NO.	VOLUME NO.
Whitehorse	Alternative Routes	Aug 11-15	51-55	18)	
Yellowknife	Supplement - CAGPL	Sept 24	68	18A)	
Yellowknife	Supplement - CARC	Oct 20-21	75-76	18B)	1
Yellowknife	Supplement - CARC	Oct. 21	76	18C)	
Yellowknife	Supplement - CAGPL	Nov. 20	91	18D)	
Whitehorse	Community hearing	Aug 11-14	22-23	19	4
Yellowknife	Policy (Foothills)	Aug 18-21	56-59	20	1
Yellowknife	Location (Foothills)	Aug 21-22	59-60	21	1
Trout Lake	Community hearing	Aug 23	24	22	4
Nahanni Butte	Community hearing	Aug 24	24	23	4
Fort Simpson	Community hearing	Sept 8-10	25-27	24	4
Wrigley	Community hearing	Sept 10-11	28	25	4
Jean Marie River	Community hearing	Sept. 12	29	26	4
Yellowknife	Hydraulics and Connecting Facilities (Foothills)	Sept. 15	61	27	1
Yellowknife	Design (Foothills)	Sept 15-16	61A-62	28	1
Yellowknife	Communications (Foothills)	Sept 16	62	29	1
Yellowknife	Compressor Station Design (Foothills)	Sept 17	63	30	1
Yellowknife	Metallurgy (Foothills)	Sept 17-18	63-64	31	1
Yellowknife	Geotechnical(Foothills)	Sept 18-19	64-65	32	1
Yellowknife	Construction(Foothills)	Sept 18,22, & 23	65-67	33	1
Yellowknife	Operation & Maintenance (Foothills)	Sept. 24	68	34	1
Yellowknife	Geotechnical - Frost Heave (Commission Counsel)	Sept. 25	69	35	1
Yellowknife	Pointed Mountain Pipe- line (Commission Counsel)	Sept 25-26	69-70	36	1

PLACE	SUBJECT	DATE	TRANS. NO.	SUMMARY NO.	VOLUME NO.
Pine Point	Community hearing	Oct. 6	30	37	4
Fort Resolution	Community hearing	Oct 7-8	31-32	38	4
Fort Smith	Community hearing	Oct 9	33	39	4
Fort Smith	Community hearing			39B	4
Yellowknife	Land Use Regulations (Commission Counsel)	Sept 26 Oct 14-15	71-72	40	1
Yellowknife	River Environments (Commission Counsel)	Sept 26 Oct. 15	70 72	41	1
Yellowknife	Community hearing	Oct 15-16	34	42A	4
Latham Island	Community hearing	Oct 22	35	42B	4
Yellowknife	Geotechnical Rebuttal (CAGPL)	Oct 16	73	43	1
Yellowknife	Construction Rebuttal (CAGPL)	Oct 17	74	44	1
	Supplement	Nov 13	86	44A	1
Yellowknife	Alternative Routes East of Franklin(CARC)	Oct 22	77	45	1
Yellowknife	Alternative Corridors (CARC)	Oct 22-23	77-78	46	1
Yellowknife	Air, Water & Terrain (CAGPL)	Oct 23 Nov 3-8 Nov 12-13	79-86	47	2
Yellowknife	Air, Water & Terrain (Foothills)	Nov 13-14 17	86-88	48	2
Yellowknife	Living Environment (CAGPL)	Nov 17-21 Dec 1-5 Dec 8-9	88A-99	49	2
Yellowknife	Living Environment (Foothills)	Dec 9-11	99-100	50	2
Yellowknife	Physical Environment (CARC)	Dec 11-12	101-102	51	2
Yellowknife	Rare & Endangered Species (CARC)	Dec. 12	102	52	2
Yellowknife	Fish (CARC)	Dec 15-17	103-105	53	2

PLACE	SUBJECT	DATE	TRANS. NO.	SUMMARY NO.	VOLUME NO.
Yellowknife	Caribou (CARC)	Dec 17-18 Jan 15-16	105-106 110-111	54	2
Inuvik	Delta Producers General Overview	Jan. 20	112	55	3
Inuvik	Delta Ecology Delta Producers	Jan. 20	112	56	3
Inuvik	Socio-Economic Overview Delta Producers	Jan. 21	113	57	3
Inuvik	Taglu Gas Development Project (Delta Producers)	Jan. 22	114	58	3
Inuvik	Niglintgak Gas Development Project (Delta Producers)	Jan 22-23	114 115	59	3
Inuvik	Parsons Lake Gas Development Project (Delta Producers)	Jan 23-24	115 116	60	3
Inuvik	Environmental Impact (Delta Producers)	Jan. 24	116 117	61	3
Inuvik	Socio-Economic Aspects (Delta Producers)	Jan 26-27	117 118	62	3
Inuvik	Policy (Delta Producers)	Jan. 27	118	63	3
Inuvik	Scenario for Future Petroleum Development (COPE)	Jan. 28	119	64	3
Inuvik	Oil Spills & Pipeline Rupture - Beaufort-Delta (COPE)	Feb. 13	124	64A	3
Inuvik	Hazardous Oil & Gas Field Materials (COPE)	Jan. 28	119	65	3
Inuvik	Offshore Petroleum Exploration (COPE)	Jan 28-29	119 120	66	3
Inuvik	Historical View of Mackenzie Delta Wild- life (COPE)	Jan. 29	120	67	3
Inuvik	Impact of Development on Delta-Beaufort Wildlife (COPE)	Feb 10-11	121 122	67A	3

PLACE	SUBJECT	DATE	TRANS. NO.	SUMMARY NO.	VOLUME NO.
Inuvik	Community hearing	Jan 28-29	36	68A	4
Inuvik	Community hearing	Feb 10,12 15,18	37-39	68B	4
Inuvik	Regional Planning in Mackenzie Delta (Commission Counsel)	Feb. 12	123	69A	3
Inuvik	Oil Spill Contingency Planning & Environmental Considerations (COPE)	Feb 14-15	125 126	69B	3
Inuvik	Historical Review of Hydrocarbon Exploration in Delta, Impact of Seismic Operation on Wildlife, Dept. of Fisheries Concerns (COPE)	Feb. 17	127-128	69C	3
Inuvik	Demand & Supply of Granular Materials in Delta Accumulative Impacts on Wildlife (Commission Counsel)	Feb 18-19	128-129	69D	3
Holman Island	Community hearing	Mar 2-3	41	70	4
Sachs Harbour	Community hearing	Mar 4-5	42	71	4
North Star Harbour	Community hearing	Mar. 7	43	72	4
Tuktoyaktuk	Community hearing	Mar 8-9	44	73A	4
Tuktoyaktuk	Community hearing	Mar. 10	45	73B	4
Paulatuk	Community hearing	Mar. 11	46	74	4
Arctic Red River	Community hearing	Mar. 13	47	75	4
Yellowknife	Cross-Delta Routing, Technical/Engineering (CAGPL)	Mar 18-20	130-132	76	3
Yellowknife	Cross-Delta Routing, Environmental Impact (CAGPL)	Mar 23-26	133-136	77	3
Yellowknife	Water Quality Criteria (Commission Counsel)	Mar 25-26	135-136	78	2

PLACE	SUBJECT	DATE	TRANS. NO.	SUMMARY NO.	VOLUME NO.
Yellowknife	Impact on Domestic Fisheries (Commission Counsel)	Mar. 26	136	79	2
Yellowknife	Environmental Impact and Route Selection Methodology (Commission Counsel)	Jan 16 & Apr 15	111& 137	80	2
Yellowknife	Pipeline Impact on Management of Fish, Wildlife and Birds (Commission Counsel)	Apr 5-7	137, 138 & 139	81	2
Yellowknife	Aircraft Regulation (Commission Counsel)	Apr. 7	139	82	2
Yellowknife	The Mizushima Oil Spill (COPE)	Apr 17-18	139-140	83	3
Yellowknife	Past Developments & Consultation in the Delta/Beaufort Region (COPE)	Apr 8-9	140-141	84	3
Yellowknife	NORTRAN (CAGPL and Foothills)	Apr 13-14	142-143	85	5
Yellowknife	Overview of Aboriginal Rights (IB of N.W.T.)	Apr. 14	143	86	5
Yellowknife	Idea of Nation Among Indian People (IBNWT)	Apr. 14	143	87	5
Yellowknife	Aboriginal Rights and Exploitation of Northern Resources 1870-1939 (IBNWT)	Apr. 14	143	88	5
Yellowknife	Aboriginal Rights: A Legal Perspective (IBNWT)	Apr. 15	144	89	5
Yellowknife	Dene Nation and Confederation (IBNWT)	Apr. 14	143-A	90	5
Yellowknife	Nation & Nationalism in the Third World (IBNWT)	Apr. 15	144	91	5
Yellowknife	Colonial Political Institutions (IBNWT)			92A	5
Yellowknife	The Dene Political System (IBNWT)	Apr. 15	144	92B	5

PLACE	SUBJECT	DATE	TRANS. NO.	SUMMARY NO.	VOLUME NO.
Yellowknife	Oxfam Statement (IBNWT)	Apr. 26	145	93	5
Yellowknife	Impact of Large-Scale Projects on Native People (IBNWT)	Apr 27-28	146-147	94	5
Yellowknife	Dene Land Use and Occupancy (IBNWT)	Apr 28-29	147-148	95	5
Yellowknife	Land Use by Slavey and Great Bear Lake Indians (IBNWT)	Apr. 29	148	96-A	5

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